ELECTRICAL WEST

A McGRAW-HILL PUBLICATION

October 1959
50 Cents

What Are Copter Costs?

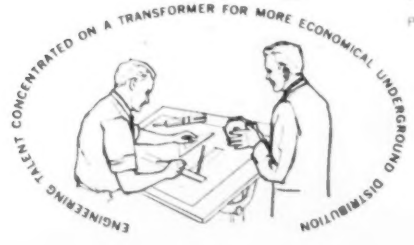
CLEAR HORIZONS

for modern construction are now possible with RT&E's Terra-Tran for underground distribution. Terra-Tran provides improved appearance for residential areas, more reliability for industrial plants, greater safety for institutions, and freedom from primary wires and poles for shopping centers. Terra-Tran is truly the long-sought key to economical underground distribution.

RT&E CORPORATION

WAUKESHA, WISCONSIN

PORTLAND, OREGON



HH

editorial views

Advisory Board

Pacific Southwest Region

J. F. Davenport, Executive Vice-President
Southern California Edison Co., Los Angeles
R. H. Cockfield, General Sales Manager
Department of Water & Power, Los Angeles
Joseph Pengilly, Vice-President
Square D Co., Los Angeles
Leonard Hobbs, Vice-President
Smoot-Holman Co., Inglewood
H. C. Gerster, Manager, Western Zone
General Electric Supply Co., Los Angeles
Sidney Hill
Hill Electric Co., Los Angeles
C. M. Smith, Sales Manager
Fluor Corp., Los Angeles
Victor Hartley, Managing Director
PCEA, Los Angeles

Northern California Region

Walter Maytham, Vice-President
Westinghouse Electric Corp., San Francisco
Norman R. Sutherland, President
Pacific Gas & Electric Co., San Francisco
Fred Nicholas
F. M. Nicholas Co., San Francisco
Alfred H. Meyer, President
Leo J. Meyberg Co., San Francisco
Arthur Dahl, Sales Manager
General Electric Supply Co., San Francisco
Paul Churchill, Regional Manager
Line Material Industries, South San Francisco
George Abbett, President
Abbett Electric Co., San Francisco
Karl Bausch, Chief Electrical Engineer
Bechtel Corp., San Francisco
Walter Bayha
Bayha, Weir & Finato, San Francisco

Intermountain Region

R. D. Moody, Manager
Allis-Chalmers Mfg. Co., Denver
David B. Hyer Jr., President
Southern Colorado Power Co., Pueblo
D. E. Provost
Stearns-Roger Mfg. Co., Denver
Ralph Johnson, Vice-President & General
Manager, Sturgeon Electric Co., Denver
Ken G. Eaton, District Manager
Anaconda Wire & Cable Co., Denver
Howard Peterson
Peterson Co., Denver
Ralph Hubbard, Managing Director
RMEL, Denver
W. W. Bowman, Director of Publicity
Utah Power & Light Co., Salt Lake City
A. E. Fleming, District Manager
General Electric Supply Co., Denver
John Kimball, Vice-President & General
Manager, Idaho Power Co., Boise

Pacific Northwest Region

Eric Nelson
Shafer & Nelson, Seattle
Charles H. Cutter, Northwest Representative
Federal Pacific Electric Co., Seattle
Ralph James
Northwestern Agencies, Seattle
R. B. Lane, President
Industrial Electric Co., Seattle
Beverly Travis, Consulting Engineer
Seattle
Eugene Starr, Chief Engineer
Bonneville Power Administration, Portland
Thomas W. Delzell, Chairman of Board
Portland General Electric Co., Portland
D. R. McClung, President
Pacific Power & Light Co., Portland
James F. Grieve, Vice-President
C. C. Moore, Engineers, Portland
Max Wood
Schwager-Wood Co., Portland
R. H. Sroufe, Executive Vice-President
Stubbs Electric Co., Portland
Alden F. Krieg, Managing Director
NELPA, Portland
Jack D. Stevens
Puget Sound Utilities Council, Seattle

New Role for Associations—An interesting sidelight to the story (p 70) is the fact that a large helicopter had to be brought into the area, not from a neighboring town or state but from Canada. Southern California Edison's development of helicopter construction presents exciting opportunities. However the economics of the ownership of such a craft, even for a large utility, are at this time questionable. For a small utility these craft are out of the question. The Yuma Axis steam plant, which brings joint benefits to Arizona Public Service and Calectric Power, as well as the now established principle of interchanging power, is a trend in cooperative enterprise that may suggest a pattern for the ownership of tremendously expensive construction tools.

Would it be out of line to suggest that a task force of various utility engineers might evaluate helicopter construction from the joint usage viewpoint? Perhaps our Western associations will once again prove to be the catalyst for progress by representing a group of utilities and encouraging joint use of expensive new tools.

Overseas Engineering—A lot could be written about the differences between the ways European engineers and American engineers would tackle a given problem. The approaches toward the solution are different because each area has special conditions, such as economics, foreign exchange, availability of materials and many others that have to be satisfied.

Probably the greatest difference to be noted in the European area is the lack of standardization of equipment as we know it here in the U. S. European manufacturers (and European customers) do not appear to strive for such standardization deliberately for the many good reasons that this country has come to demand. Probably this stems from the fact that many manufacturers in many countries offer their equipment in a more or less common electrical market. Thus the problem of international standardization of even such things as mounting brackets is a formidable one. Engineering costs, too, may be relatively lower and competition is keen so that special designs become a way of doing business.

The end result is that the plant or system with combinations of English, German, Swiss and Swedish equipment is commonplace. Quite often there is incorporated special designs to meet specific problems. As a result, many installations represent real interest to engineers although one might well wonder how costly such installation might be as measured by U. S. practice.

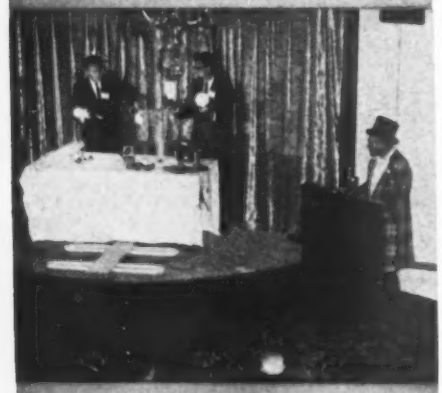
Forty Million for Juneau?—Senator E. L. Bartlett (D-Alaska) has announced that he will introduce legislation in Congress authorizing a $40 million federal power project near Juneau if the Georgia Pacific Alaska Co. agrees to build a pulp mill in the area and to purchase 230 of the anticipated 290 million firm kwh. According to Senator Bartlett, "This project would give the Juneau area a mighty boost, it would enable a large new industry to operate, greatly reduce the rates electricity consumers now pay and help to diversify Juneau's government-heavy economy."

A survey indicates that power not used by the mill would be absorbed within three years. Firm power would be sold at wholesale rates of 6.3 mills per kwh rather than the present 15 to 27 mills.

Efforts such as this are at best politically irresponsible. Why should the taxpayers of the nation foot the bill for a power plant whose output would be primarily for the benefit of a business firm? Why shouldn't business itself put up the money if the project is economically self sustaining? If it isn't, business won't touch it and the government shouldn't. The only excuse for subsidized power is to supply minority segments of the population who could not be served otherwise.

Progress on Project EHV 74

Control Does It 84



IES Treks West for National ... 90

Inspectors Check New Code ... 93

ELECTRICAL WEST

SPOKESMAN FOR THE MOST HIGHLY ELECTRIFIED REGION OF THE U.S. Established 1887

C. W. Leihy, Publisher and Editor
W. A. Cyr, Consulting Editor
Peggy Boyer, Associate Editor
Jack Robinson, Engineering Editor
Miriam Stuart, Editorial Assistant

George C. Tenney, President
Dale VanHorn, News Editor
Marvin Petal, Pacific Southwest Region
Frank Pitman, Intermountain Region
Ray Bloomberg, Pacific Northwest Region

CONTENTS

VOL. 123, No. 4 OCTOBER 1959

People Do All Three by Ralph Johnson 67
What Are Copter Costs? by Jack D. Robinson 70
Electric Car Runs Out of Gas 77
Aluminum Substations by Don Campbell 78
Atomic Power Costs Crystallized 80
Luminous Sign Building Front 86
Methods of Starting Motors by Tom Hughes 89

Cover: Pack mules—modern style. For story of Southern California Edison Co.'s experimental helicopter construction jobs, see page 70.

DEPARTMENTS

Bulletins 28
Construction News 87
Editorials 1
Letters to the Editor 62
News 108
News Roundup 8
Product News 17
Advertising Index 134, 135

ADVERTISING REPRESENTATIVES

ATLANTA 3: Robert Powell, Rhodes Haverty Bldg.; CHICAGO 11: W. C. McMurray Jr., 520 N. Michigan Ave.; PITTSBURGH 22: Francis X. Roberts, 1111 Henry W. Oliver Bldg.; DENVER 2: John Patten, 1740 Broadway, AL 5-2981; LOS ANGELES 17: Russ Antles, 1125 W. Sixth St., HU 2-5450; NEW YORK 36: Dick Thompson, 500 Fifth Ave.; SAN FRANCISCO 4: T. H. Carmody, Advertising Sales Manager, Don Farris, Dick Alcorn, Bernice Johnston, Advertising Production Manager, 68 Post St., DO 2-4600.

Offices: Boston, Cleveland, Dallas, Detroit, Philadelphia, St. Louis

Electrical West (with which is consolidated The Journal of Electricity), October 1959, Vol. 123, No. 4. Published semimonthly except November when published trimonthly by McGraw-Hill Company of California, James H. McGraw (1860-1948) Founder. Office of publication, 235 N.W. Park Ave., Portland 9, Ore. See panel below for directions regarding subscriptions or change of address.

Executive, editorial, circulation and advertising offices: 68 Post St., San Francisco 4, Calif. Donald C. McGraw, chairman of the board; George C. Tenney, president; John W. Otterson, vice-president; B. M. Boccoli, secretary and treasurer.

Position and company connection must be indicated on subscription orders. Send to address shown in panel below. Subscription price includes the regular monthly issue, the news letter issue and the November directory issue. United States subscription rate $3 a year, single copies 50c (November directory issue $1). Latin American Republics and Philippine Islands $4 a year; Canada $3.50 a year; all other countries $4 a year. Entered as second class matter, Dec. 17, 1956, at the post office at Portland, Ore., under the act of March 3, 1879. Printed in U. S. A. Title registered in U. S. Patent Office. © Copyright 1959, McGraw-Hill Company of California. All rights reserved.

SUBSCRIPTIONS: Send subscription correspondence and change of address to Subscription Manager, Electrical West, 68 Post St., San Francisco 4, Calif. Allow 30 days for change of address.

Postmaster: please send notice 3579 to Electrical West, 68 Post St., San Francisco 4, Calif.

THIS ALL-L-M TRANSCLOSURE INSTALLATION

houses a Round-Wound® distribution transformer, lightning arrester, a Kyle Type NR oil switch, disconnect switch, pothead, potential transformer and secondary breakers, to supply two fully protected lighting circuits.

TRANSCLOSURE INSTALLATIONS will not obstruct traffic vision and can be completely hidden with shrubs. The safety and beauty of well-designed highways will not be disturbed.

New L-M Transclosures Save $1,750 On Each Highway Lighting Transformer Installation

New enclosure with modular construction offers savings in cost, erection time and space; permits transformer installations at the load center.

by C. W. PETERSEN, Product Manager
Line Construction Materials
Line Material Industries

Costs of expressway and highway lighting can be greatly reduced by use of the new L-M Transclosure(TM) for all transformer installations. The Transclosure will house a standard oil-filled transformer, lightning arrester, oil switch, disconnect switch, pothead, secondary breakers and potential transformer. Using the Transclosure instead of the conventional concrete block or brick housing offers an estimated saving of $1,750 per transformer installation. On a projected 60 miles of highway, where 100 to 125 installations are expected, a total saving of from $175,000 to $218,000 is anticipated.

Basically the Transclosure is a weatherproof enclosure, fabricated of heavy-gauge steel, to be mounted on a concrete pad. It houses the transformer and associated equipment. It provides ample ventilation for the transformer by means of vents at top and bottom, with baffles to prohibit entrance of all foreign objects, including wildlife. Removable primary and secondary doors can be padlocked to prevent unauthorized personnel from entering, yet they provide complete and easy access to the equipment.

Interlocking design assures a weatherproof housing; the sloped roof sheds rain. Modular construction permits ganging the units to provide whatever space is required. Units may also be expanded vertically by installation of larger side panels and bottom vents. Transclosures are available in three sizes, to accommodate transformers up to 100 kva. Small in size and light in weight, they are designed to be assembled at the job site. A complete installation, including transformer and associated equipment, has been installed with less than two man-days of labor.

The clean, low lines produce a silhouette that does not detract from highway beauty or obstruct traffic vision. Low shrubs will hide the entire installation completely. Transclosures may be installed precisely at the lighting load center, eliminating all overhead construction and producing the shortest and most economical secondary runs.

Get Complete Information

These are just a few of the reasons why many engineers are specifying this new approach to inexpensive highway lighting. For complete details, contact your L-M Field Engineer or Lighting Engineer or write me direct at Line Material Industries, Milwaukee 1, Wisconsin. 407

LINE MATERIAL® Industries *Transclosures*

McGRAW-EDISON COMPANY

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS
POWER SWITCHING EQUIPMENT • PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING
LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

McGRAW EDISON

now! OZ

ALUMINUM FITTINGS

[FOR ALUMINUM CONDUIT]

AT NO INCREASE IN PRICE!

O.Z. now offers a full line of aluminum fittings, keeping pace with increased demands for rigid aluminum conduit... Cable Supports, Expansion Fittings, End Fittings, Split Couplings, Pull Box Fittings, U-Bolts, Terminators, Flanges and O.Z. Types "B", and "SB", Bushings. Here is a premium line of fittings — at standard prices. O.Z. Aluminum Fittings are identical in design, workmanship and quality to similar O.Z. products in malleable iron and other metals. Whatever your requirements, O.Z. has the type and size you need.

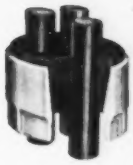
When ordering any of the standard fittings illustrated, specify "aluminum" after the catalog number.

O.Z. Aluminum Conduit Fittings are at your local distributor now. For more complete information, see your distributor, or write direct to the company.

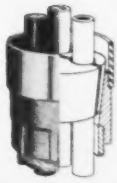
CABLE SUPPORTS

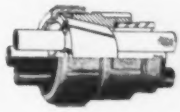
TYPE "S"

TYPE "R"

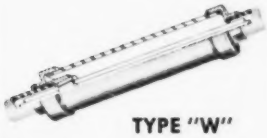


TYPE "C"



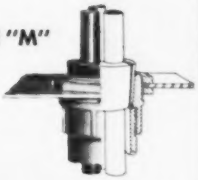


TYPE "K"



TYPE "W"

TYPE "M"

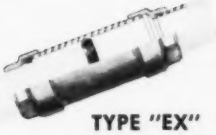


BUSHINGS

TYPE "B"

TYPE "SB"

EXPANSION FITTINGS



TYPE "EX"

TYPE "AX"

TYPE "EXE"

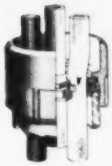
TYPE "DX"

Patented

CABLE TERMINATORS

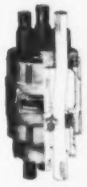
TYPE "FR"

COMPOUND BUSHINGS



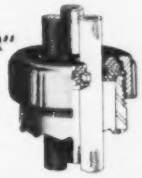
TYPE "DTC"

WITH TAPING CONES



TYPE "KR"

SEALING BUSHING



TYPE "CRH"

HORIZONTAL TERMINATOR

TYPE "CRC"

WITH TOP COVER

TYPE "CLN"

WITH TOP THREAD

PULL BOX FITTINGS

TYPE "PB"

NON-WEATHERTIGHT

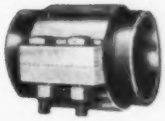
TYPE "PBW"

WEATHERTIGHT

END FITTINGS

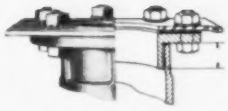
TYPE "E"

SPLIT COUPLINGS



TYPE "SP"

FLANGES



UNIVERSAL FLANGES

U-BOLTS

Priced same as Bronze U-Bolts

O.Z.

ELECTRICAL MANUFACTURING CO., INC.

262 BOND STREET • BROOKLYN 17, N. Y.

Sales Office and Warehouse: 406 So. Cicero Avenue, Chicago 44, Ill. • ESterbrook 9-0326
Office and Factory: 749 Bryant Street, San Francisco 7, Calif. • GArfield 1-7846

- CAST IRON BOXES
- CABLE TERMINATORS
- POWER CONNECTORS
- SOLDERLESS CONNECTORS
- GROUNDING DEVICES
- CONDUIT FITTINGS
- INTERLOCKED ARMOR CABLE FITTINGS

your products are in the spotlight in the fastest growing market when you exhibit in the

10TH Biennial

ELECTRICAL INDUSTRY SHOW

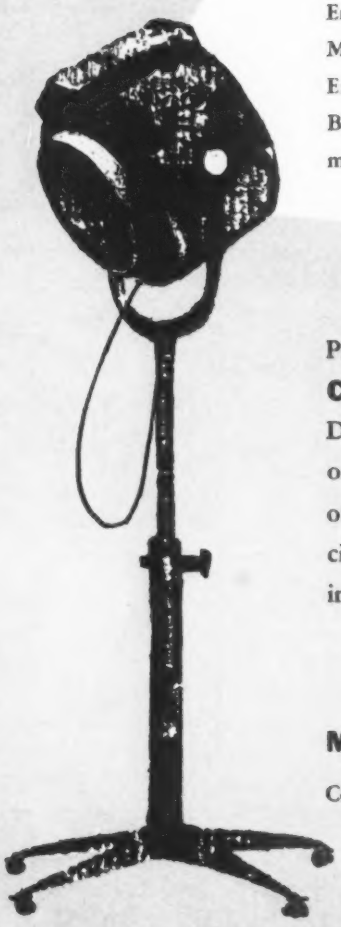
Presented by the Electrical Maintenance Engineers Association of California

MARCH 23-26, 1960

SHRINE EXPOSITION HALL • LOS ANGELES

Over 12,000 potential customers from 13 WESTERN STATES

Architects, Contractors, Draftsmen, Electricians, Chief Plant Engineers, Consulting Engineers, Design Development Engineers, Electrical Engineers, Electronic Engineers, Production Management Engineers, Maintenance Engineers, Estimators, Management, Mechanical Engineers, Purchasing Agents, Technicians, Utility Consultants, Builders, School Superintendents, State, County and City Government Construction Officials will attend this important show.



Presenting for the first time a

COMPLETE LIGHTING EXPOSITION

Dedicated to the latest advance in commercial, industrial, office, school, and outdoor lighting. Under the chairmanship of Urban Beh, Consulting Lighting Engineer—with highly specialized technical sessions presented by foremost authorities in the various fields.

MAKE YOUR SPACE RESERVATION TODAY

Contact: Fred J. Tabery, EMEA Exhibit Manager
3443 South Hill Street
Los Angeles, Calif.
Telephone: RIchmond 9-1091

FIVE NEW GEDNEY PRODUCTS . . .

"that fit always!"

Nobody knows better than you do how much time, trouble and expense are involved when electrical fittings don't fit properly. That's why Gedney has adopted the simplest of mottoes: *Gedney Fittings fit.* And we mean it!

Gedney Fittings are machined with unfailing accuracy, then carefully finished, finally they're scrupulously inspected. *Result?* You no longer have to make allowances for the fittings (and time) you used to throw away! One more thing. These better fittings cost you no more!

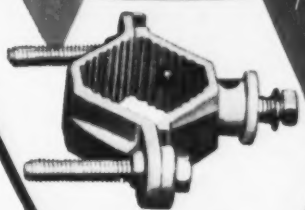
Think of all the places you can save time and money with these five new Gedney Fittings and Accessories!

GEDNEY INSULATED MALLEABLE IRON BUSHINGS (cadmium-plated). Polyethylene collar is free to turn while bushing is tightened . . . prevents binding, twisting, during installation. Sizes ½" to 6".

GEDNEY JUMPER WIRE BONDING BUSHING. Solderless lug. Malleable iron, cadmium-plated, available sizes ½" to 4".

GEDNEY INSULATED MALLEABLE IRON GROUND BUSHINGS (cadmium-plated). Solderless lug. Free-turning polyethylene collar prevents binding, twisting, of conductors. Sizes ½" to 4".

GEDNEY PUSH-PULL TAB CAP. For plugging bushings, etc. Use again and again. Strong polyethylene, in sizes ½" to 2".



GEDNEY STATIC PREVENTIVE GROUND CLAMPS. Made to ground pipe or conduit from ½" to 8".

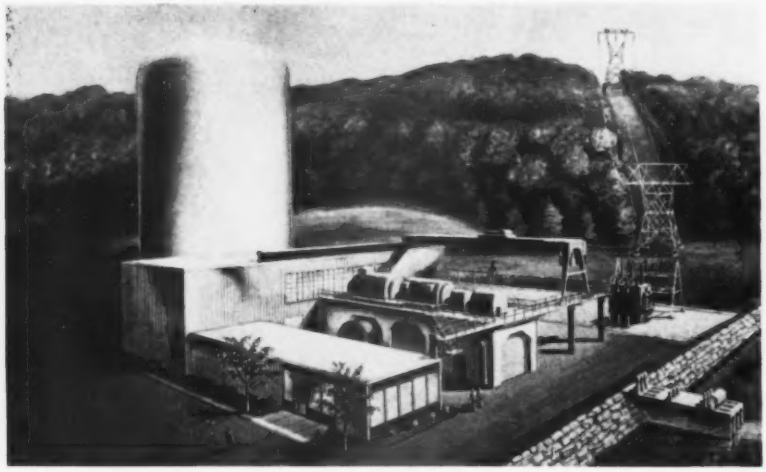
GEDNEY FITTINGS FIT

GEDNEY
ELECTRIC COMPANY

RKO BLDG. • RADIO CITY • NEW YORK 20
Foundry, Factory and Shipping Point: Terryville, Conn.

For phone number of closest representative see advertising index in back of book.

EW news roundup



This is an artist's conception of a new reactor development of interest to 52 utilities

ATOMIC SHORTCUT? — The $24½ million atomic reactor system recently approved by Congress is viewed by some as a "major shortcut to the development of the nation's goal of economic electricity from the atom."

J. F. Davenport, executive vice-president of Southern California Edison, which is one of the 52 investor-owned utilities cooperating in the project, made that comment following the signing of the contract with the AEC.

The companies participating in building of the 40,000-kw system at Peach Bottom, Pa., make up the largest and most widely representative group of utilities ever to support an atomic power project. The group is called the High Temperature Reactor Development Assn. It is providing both financial and technical support for the project which will be incorporated in the Philadelphia Electric Co. system.

General Atomics, a division of General Dynamics, will build it.

—EW—

SHAKE-UP—A Department of the Interior report reveals that the earthquake near West Yellowstone, Mont., in mid-August changed water levels throughout the country temporarily.

Automatic water-stage recorders operated by the Geological Survey for hydrologic studies registered water levels that were higher by ¼ to 17 in. At some places the effect was so strong that recorders "jumped the track" so the full amount of water-level change could not be determined.

A well in Union County, N.J., had the largest fluctuation—17 in.

Particularly interesting is the fact that three wells on the island of Oahu, Hawaii, showed water-level changes about ¼ to ¾ of an inch. This was 3,200 miles from the epicenter.

—EW—

LIGHT AND PROFITS—In a before-and-after study of cost sheets, the Don Martin Sportswear Co. in Los Angeles has come up with interesting test data regarding the importance of illumination from the standpoint of profits, labor relations and incidence of accidents.

The company, founded two years ago by the Garcia brothers, designs slacks and blouses for Grayson's, Lerner's and comparable outlets. Anticipating moving to a modern building in the near future, the owners limited expenditures for modernization of lighting at their present location to minimum requirements of 100 f-c, as outlined by illumination engineers. Lowest cost fixtures and installation were used and no other change was made in working conditions or physical facilities in the factory.

The company kept close check on profits, production output, accident ratio, etc., for three months immediately preceding the new installation and for another three months immediately afterwards. Since the company, in this period, had a backlog of orders for merchandise, general business conditions or seasonal slack periods had no effect on outcome of the test.

Here are the startling facts:

Average gross income for the two periods under consideration showed an increase of 44% after defective lighting had been corrected.

Against the 44% figure, cost of energy for operation of the new fixtures amounts to 3/10 of 1% of the additional monthly gross, and total cost of installation, based on a 5% net of the gross increase, was paid off in 38 working days.

Accurate records of four machine operators, each of whom has been with the company from its inception, were charted in order to determine effects of the new setup on individual piecework production. Results showed that:

1. The top producer in the factory increased her output by 15% working in better light.
2. A high average producer increased her output 13%.
3. A low average producer increased her output 45%.
4. Previously the slowest and least competent employee in the plant increased her output by 164%.

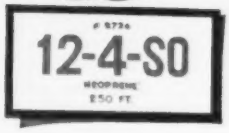
Accidents in the factory declined from an average ratio of 2.5 accidents per month, most of which were needle punctures, to a single accident in the next three months, which was a back injury resulting from the strain of heavy lifting.

The owners report that complaints

HOTTEST BRAND IN CABLE !

CAROL

4/3 TYPE W CAROL



Planned Packaging. Sturdy, quick opening, self-dispensing cartons. Exclusive Inventory Keeper that minimizes waste, simplifies inventory control.

Plywood Reels. "No-charge" Plywood Reels for 14, 12 and 10 gauge portable cord, 500 or 1000 feet per reel.

Every Foot Imprinting. Tells you at a glance the gauge, number of conductors, voltage, type of insulation.

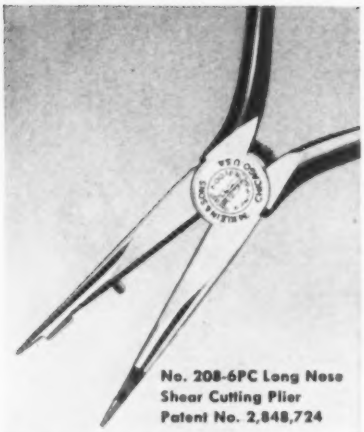
Color Coded Labels. Shows gauge, type and contents . . . saves time . . . simplifies inventory. Red labels indicate neoprene, black indicates rubber.

When you call for cable . . . call for Carol

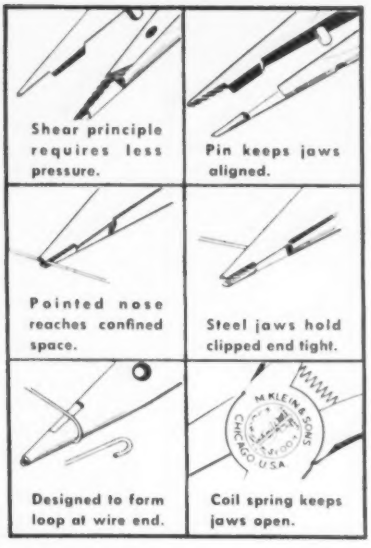
Carol®

CAROL CABLE COMPANY Division of the Crescent Company, Inc., Pawtucket, R. I.

For phone number of closest representative see advertising index in back of book.



JUST THE PLIER FOR ELECTRONIC USE


Shear principle requires less pressure.
Pin keeps jaws aligned.
Pointed nose reaches confined space.
Steel jaws hold clipped end tight.
Designed to form loop at wire end.
Coil spring keeps jaws open.

Here is a plier specially designed for electronic use. It will fit into confined space and steel jaws hold clipped end of sheared wire firmly . . . nothing to wear out.

The shear blade is at an angle of 15 degrees (the standard angle of regular diagonal pliers). Shear principle assures smooth, continuous action without snap, preventing shock which might damage transistors or delicate components. For use with bare wire up to 18 gauge.

See your electronic supply house or

WRITE FOR CATALOG 101-A

Foreign Distributor: International Standard Electric Corp., New York.

Mathias KLEIN & Sons Established 1857 Chicago 45, Illinois

from employees melted to almost nothing; absenteeism, which had been high, showed a marked drop and other personnel problems dwindled to a negligible low.

The owners say that while improved illumination is most effective in aiding the visually handicapped, it increases efficiency even among those with perfect vision. They anticipate that insurance rates under improved conditions will drop in ratio with the drop in accidents.

—EW—

Marvin Lee has been elected president of Burndy Corp. to succeed Bern Dibner, who was elected chairman of the board of directors. Dibner, the founder of Burndy, is also president and founder of Burndy Library, chairman of the Electrical Historical Foundation, trustee of the University of Bridgeport and of the Yale Medical Library, member of the Electrical Equipment Committee of the Smithsonian Institution and Fellow, American Institute of Electrical Engineers.

—EW—

WHAT RACE?—Russia is not engaged in a race with the United States or any other country in development of atomic power, James F. Davenport, executive vice-president of Southern California Edison Co., said in a report on his 10,000-mile trip through the Siberian area of the Soviet Union.

"Conventional steam plants enjoy the top construction priority in the electrical field in Russia," Davenport told the Electrical Conference of the Petroleum Industry, holding its annual national convention in Long Beach.

"Second priority is given hydroelectric power construction — with atomic plants in third place."

The Edison executive explained that the Russians have a tremendous industrial expansion program to achieve before they can begin substantial increases in consumer goods and compete in world markets.

"Consequently, they need huge blocks of power quickly, and they don't care how they get it—from steam, falling water, or the atom," Davenport declared.

Davenport estimated that the Russians are approximately 10 years behind the United States in development of automation in power plants.

"This does not necessarily imply any lack of ability to catch up—only a later start," he added. "Most of their present technology has been expertly adapted, and this process doubtless will continue until the gap is closed or at least substantially narrowed."

—EW—

Electroluminescence, infant of the lighting industry, will be found on 1960 Chrysler and Imperial automobile dashboards. Sylvania Electric Products worked with the auto manufacturer on the development.

—EW—

NEW FORMULA—A new mathematical formula has been proposed by Allis-Chalmers engineers for overcurrent relay selection and coordination.

This formula $I^n t = k$ provides simple, straight line functions when plotted on double logarithm paper. In the formula, "I" represents multiples of tap value current; "t" is time in suitable units; "k" is time scale index and "n" is inversion index.

Static relays now available can be adjusted to change the slope of the time-current curve (inversion index) or the time to trip (time index) for coordinating any given circuit.

The engineers say much confusion can be eliminated in relay coordination by simply indicating values for the inversion index and time scale index of the relay being coordinated with other protective devices on the system.

—EW—

"It's an I for an I when two egotists get together," announces the Chewelah, Wash., The Independent.

—EW—

LOW BIDDER — Baldwin-Lima-Hamilton Corp., in a release explaining the way it was low bidder on three 48,300-hp hydraulic turbines for Wheeler Dam of TVA, states:

"It is with great regret that the management of Baldwin-Lima-Hamilton Corp. deemed it necessary to use a substantial amount of foreign material and labor but there seemed no alternative if the corporation is to maintain its engineering skills and know-how on hydraulic turbines which have been a principal product for many years."

BLH submitted a bid of $2,313,000, which was just below the bid of English Electric Export & Trading Co., with a bid of $2,354,305.

20 miles of SPANG Conduit are being installed in all buildings now under construction in this giant building program at a Pennsylvania university.

Architects: Howell Lewis Shay and Associates, Philadelphia, Pa.
Mechanical Contractor: Riggs Distler and Company, Inc., Philadelphia, Pa.
Electrical Contractor: Lecce Electrical Company, Williamsport, Pa.
SPANG Distributor: E. R. Beers Electric Company, Bloomsburg, Pa.

"SPANG IS THE BEST CONDUIT AVAILABLE ON TODAY'S MARKET"

says Mr. Frank Gallagher, Foreman for Lecce Electrical Company, Williamsport, Pa.

"We don't have the problems with SPANG Conduit that we run into with most other conduits," states Mr. Gallagher. "Whenever my decision is called for in the purchase of conduit, I always call for SPANG; it's the finest I've used in 20 years.

"SPANG's uniform high quality means we don't have to chase bad threads or be bothered by 'hard spots,' which make bending difficult. Because less time is required to install wire runs with SPANG, there's a considerable savings in time costs.

"We're installing over 20 miles of SPANG Conduit to protect the wiring in the seven new buildings at a Pennsylvania university. We guarantee each job for one year, so we can't afford to use inferior materials. With SPANG, we know the job will be right the first time."

Quality-controlled SPANG Conduit is manufactured and inspected under rigid specifications to bring you the maximum in performance. Next job, call your local SPANG Distributor for the *top-quality* conduit that will give you *top-quality* service—SPANG.

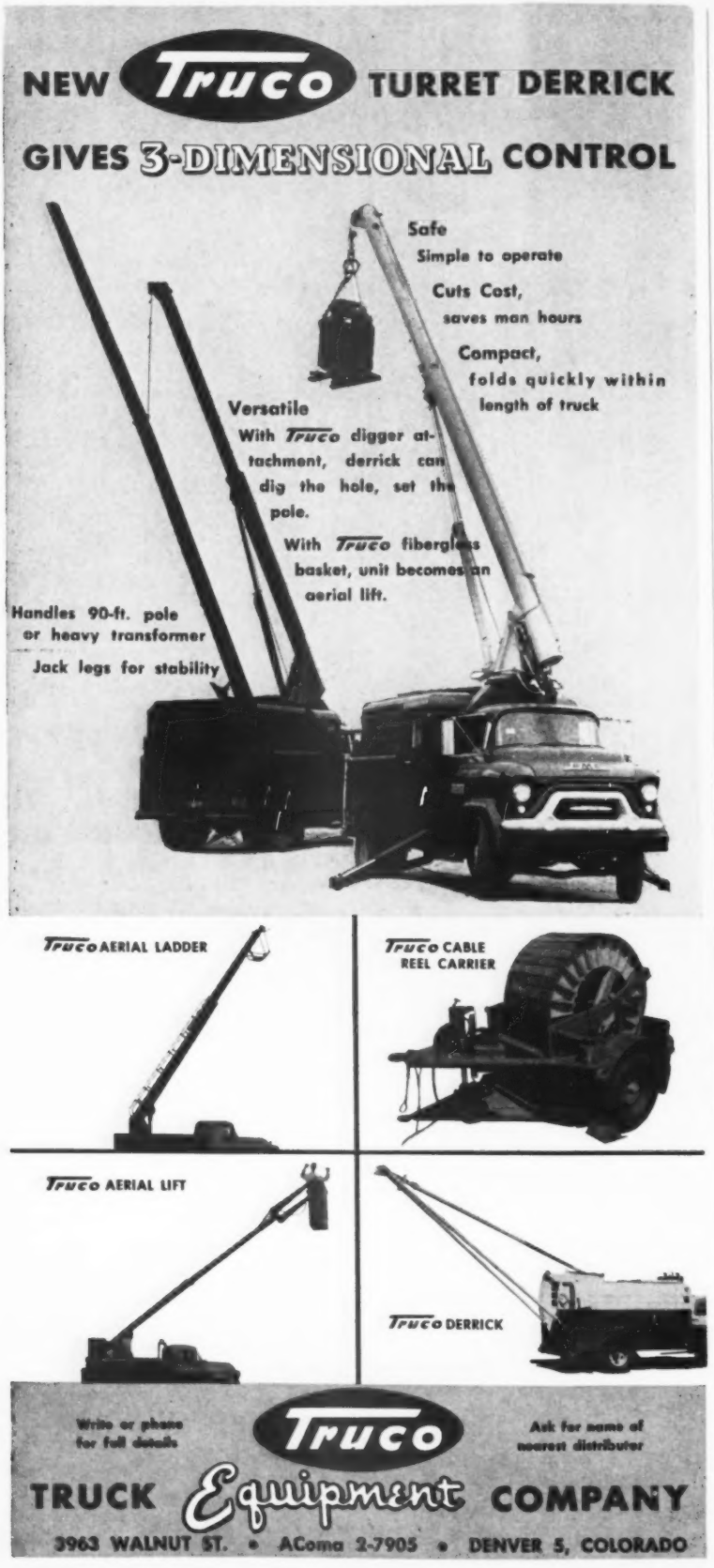
THE NATIONAL SUPPLY COMPANY

SPANG CONDUIT

Subsidiary of Armco Steel Corporation

TWO GATEWAY CENTER, PITTSBURGH, PA.

For phone number of closest representative see advertising index in back of book.


NEW Truco TURRET DERRICK
GIVES 3-DIMENSIONAL CONTROL
Safe
Simple to operate
Cuts Cost,
saves man hours
Compact,
folds quickly within
length of truck
Versatile
With Truco digger attachment, derrick can dig the hole, set the pole.
With Truco fiberglass basket, unit becomes an aerial lift.
Handles 90-ft. pole or heavy transformer
Jack legs for stability
Truco AERIAL LADDER
Truco CABLE REEL CARRIER
Truco AERIAL LIFT
Truco DERRICK
Write or phone for full details
Truco
Ask for name of nearest distributor
TRUCK Equipment COMPANY
3963 WALNUT ST. • AComa 2-7905 • DENVER 5, COLORADO

"Whether or not the government of this country will continue its present policy of accepting foreign bids on public water power projects when such bids are obviously based upon the low wage economies of foreign countries, we do not know, but if such policies do continue, American manufacturers of these products will either have to purchase substantial portions of the turbines abroad, thus maintaining their engineering skill, or go out of business entirely."

—EW—

Westinghouse Electric Corp. has been awarded a contract by the U. S. Navy to build thermoelectric air conditioner, heater and refrigerator that will produce heat and cold with solid state materials and without moving parts.

—EW—

FUEL ELEMENTS FAIL—Atomics International is still investigating the cause of the failure of fuel elements in the sodium reactor experiment at Santa Susana. They offer reassurance that fuel element damage is not an indication of unsafe reactor conditions and that no release of radioactive materials to the plant or its environs occurred.

The fuel element of SRE is a cluster of seven stainless steel tubes, each about ¾ in. in diameter and 6 ft long. Each tube contains a column of 6-in. long uranium metal slugs. The elements are suspended in the core of the reactor by means of hanger rods.

Operators discovered that a lower portion of some of the fuel elements remained in the reactor core as the elements were lifted.

Preliminary indications are that organic material in the reactor may have restricted passage of coolant. The material could have come from leaks in the primary coolant pumps where tetralin, an organic compound, is used in seals to eliminate sodium leakage into the pump bearings and drive.

Southern California Edison Co. has an experimental generating unit attached to the reactor.

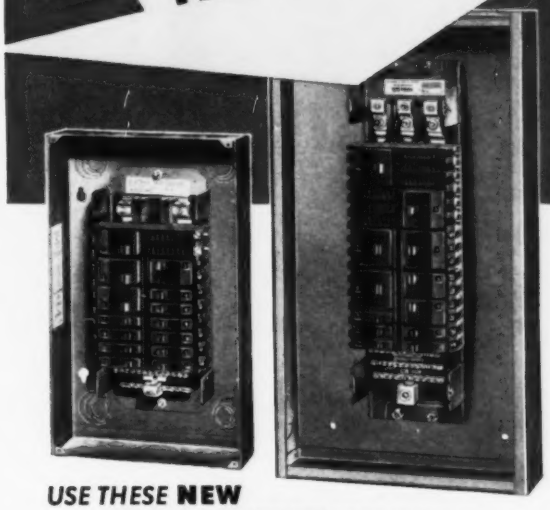
—EW—

HIGH PRICED—Electricity can be generated by nuclear energy, using natural uranium as a fuel and heavy water as a moderator for an estimated 19.1 mills a kwh, according to F. W. McCloska and C. A. Hatstat of Sergeant & Lundy, Chicago.

QO
FINEST BREAKER EVER BUILT!

NOW— 15 thru 100 amps

USE THEM in BOTH LOADCENTERS AND PANELBOARDS!



NEW! NEW!

2-POLE 70-100 Amp

3-POLE 70-100 Amp

DESIGN LEADERSHIP FEATURES OF THE NEW 100 AMP Q1 BREAKERS

- Fit all existing QO loadcenters and NQO panelboards
- Plug-in units let you assemble loadcenters and panelboards to meet any requirement
- Lugs are approved for aluminum or copper #1/0 wire
- *Quick-make, quick-break. Prevents "teasing"*
- *Trip indication. Tells instantly whether circuit has been turned off intentionally or "tripped"*
- Temperature compensated—prevents nuisance tripping
- Common trip prevents single phasing or personal injury
- Single handles for modern, streamlined appearance
- Plated jaws and connectors assure positive connections
- *Heavy-duty industrial quality for long life and trouble-free operation*

USE THESE NEW 100 AMP UNITS LIKE THIS...

As MAIN BREAKERS in any loadcenter or panelboard... just plug them in! Or as 100 ampere maximum, 2 or 3 pole BRANCH BREAKERS for motor loads, electric heating loads, and sub-feeds to other panelboards.

Write for Bulletin SD-100. Address Square D Company, 4335 Valley Boulevard, Los Angeles 32, California

THE "QO" FAMILY

QO 1-POLE 15-50 Amp | QO 2-POLE 15-70 Amp | QO 3-POLE 15-50 Amp | Q1 2-POLE 70-100 Amp | Q1 3-POLE 70-100 Amp

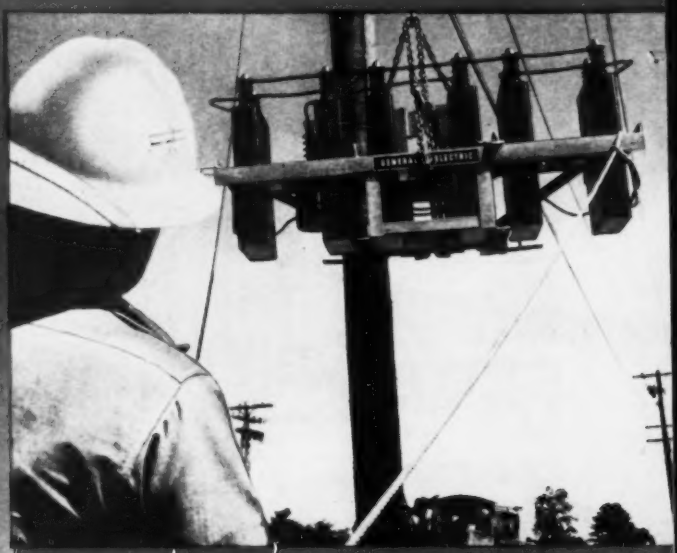
EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE

SQUARE D COMPANY

For phone number of closest representative see advertising index in back of book.

GENERAL ELECTRIC ANNOUNCES

NEW "ISOKRAFT 50" CAPACITORS



Faster, easier, less expensive installation . . .

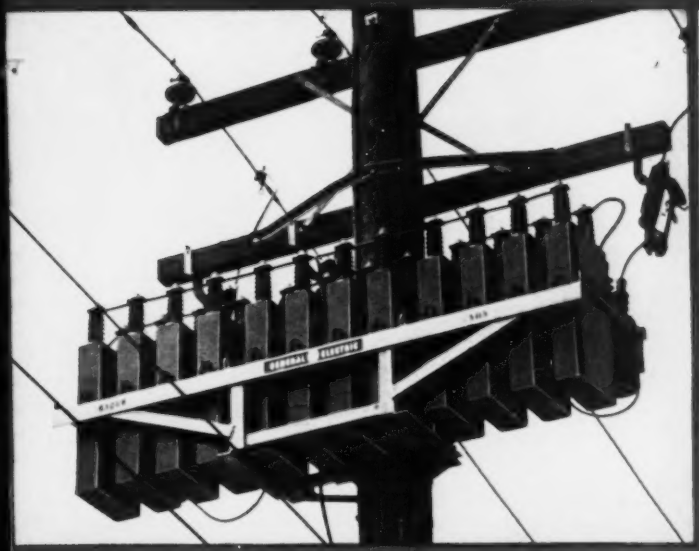
NEW "ISOKRAFT 50" CAPACITORS PERMIT

- More KVAR per pole
- Easier installation

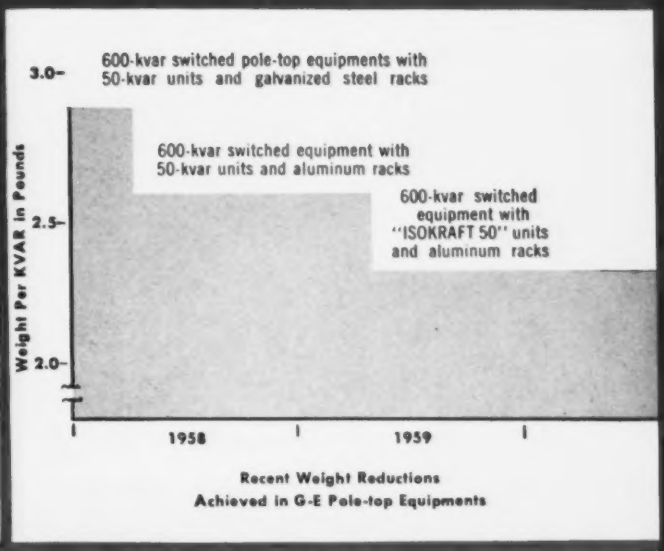
***14% lighter than previous General Electric units**

†Trade-mark of General Electric Co.

SMALLER AND 14% LIGHTER*



. . . 600-kvar equipment at 450-kvar weight are . . .


3.0–
600-kvar switched pole-top equipments with 50-kvar units and galvanized steel racks
600-kvar switched equipment with 50-kvar units and aluminum racks
600-kvar switched equipment with "ISOKRAFT 50" units and aluminum racks
Weight Per KVAR in Pounds
2.5–
2.0–
1958
1959
Recent Weight Reductions Achieved in G-E Pole-top Equipments

. . . benefits of General Electric capacitor progress.

General Electric's new "ISOKRAFT 50" capacitor weighs less than 2 pounds per kilovar, LIGHTEST 50-KVAR CAPACITOR ON THE MARKET TODAY. Lighter weight and smaller size make "ISOKRAFT 50" capacitors easier to handle and permit more kilovars per pole.

14% WEIGHT REDUCTION results from new ISOKRAFT† paper dielectric, combined with improved internal construction and manufacturing methods. New 600-kvar equipments with aluminum racks now weigh no more than older 450-kvar equipments with galvanized steel racks and heavier units. With "ISOKRAFT 50" stainless-steel case units, the new General Electric equipment permits faster, easier, less expensive installation.

GREATER RELIABILITY—Lower temperature rise and increased ability to withstand lightning and switching surges contribute to a more reliable capacitor unit.

Check to see how General Electric's new "ISOKRAFT 50" capacitors can benefit your system.

FOR COMPLETE INFORMATION, write for bulletin GEA-6990—Section 445-29, General Electric Co., Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

For phone number of closest representative see advertising index in back of book.

why choose
THIS

when you can have
THIS?

* **PRESSURE-RELIEF CAP CUTOUT** photographed in action discharging the cap, fuse link button head, and ionized gases upward into the primary

* **HUBBARD EHD FAULTMASTER CUTOUT** with exclusive Single Vent Small-Bore action discharging all gases down and away in a single confined cone.

** Both photographs are open shutter exposures, taken of cutouts tested on a 15 kv circuit with 8000 amperes available.*

Manufactured in Canada by
N. Slater Co., Hamilton, Ontario

BETTER PRODUCTS *through Creative Engineering*

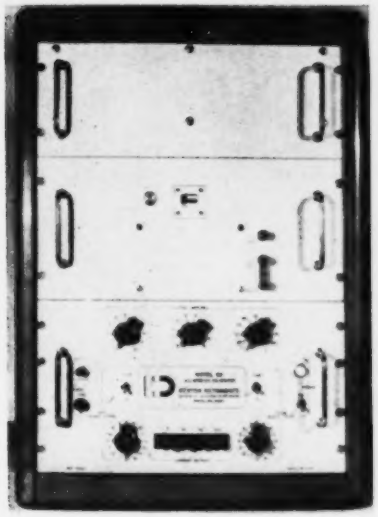
HUBBARD

AND COMPANY · 200 SOUTH MICHIGAN AVENUE · CHICAGO 4, ILLINOIS

H

PRODUCT NEWS

New Designs and Applications



Instrument Calibrators

(1) *Weston Instruments Division, Daystrom Inc., 614 Frelinghuysen Ave., Newark, N. J.*

Four new a-c and d-c instrument calibration consoles with reported calibration accuracy of .05% of indicated value are being produced by this company. The a-c and d-c calibrators provide power source, circuitry and control for virtually all types of portable, panel, switchboard and recording-type instruments used by large utilities, according to the manufacturer. Each of the complete consoles measures 30¾ in. high, 21½ in. wide and 19⅛ in. deep.

Cable-to-Flat Terminals

(2) *Burndy Corp., Norwalk, Conn.*

A line of terminals for cable-to-flat connections to aluminum or copper in wide ranges of sizes has been introduced by this company. Only eight terminal sizes cover every cable size from No. 8 through 2,000-mcm copper and aluminum or 1,780-mcm ACSR. A single connector size will take as many as 35 different cable sizes. With recessed bolt head pockets for one-hand installation, the terminals are designed to make dependable heavy-duty connections.

Safety Switch

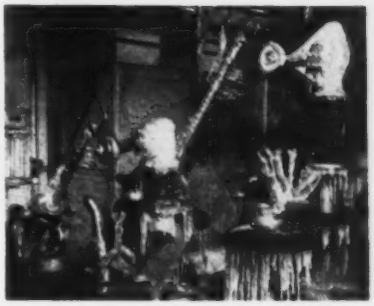
(3) *Federal Pacific Electric Co., 50 Paris St., Newark, N. J.*

A new line of heavy-duty safety switches incorporating the quick-make, quick-break principle is announced by this company. Rated from 400 amp through 1,200 amp, and with a 100,000 amp interrupting capacity when current limiting fuses are inserted, the new switches are designed for industrial application. The switches employ a circuit breaker-type mechanism in conjunction with fuses.

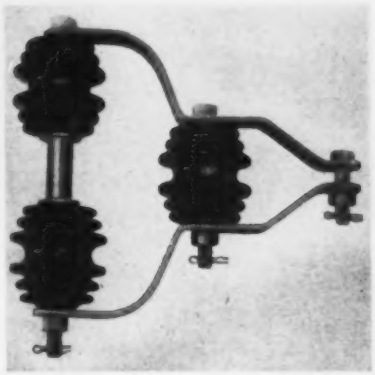
External Transformer

(4) *Allis-Chalmers Mfg. Co., 1126 S. 70th St., Milwaukee 1, Wis.*

A new external mounted bushing-type current transformer has been developed by this company for power transformers and breakers. Designed for circuit relaying, indicating or protection, the new Versaformer is installed on existing units by merely slipping it down over a power bushing. Can be used with any ASA bushing, 34.5 kv or below.



The Powerupter, a completely enclosed device for mounting on disconnect switches to interrupt currents of 600 amp and up to 34.5 kv, is shown as it was subjected to severe ice tests in a freezer chamber by Delta-Star Electric Division, H. K. Porter Co. Inc. Mounted on a vertical-break switch, the unit was frozen first in the open and then closed position under controlled laboratory freezing to obtain a minimum of ¼-in. ice accumulations. Then it was operated to check ice-breaking characteristics. Opening and closing of both disconnect and Powerupter was successful each time, the company reports

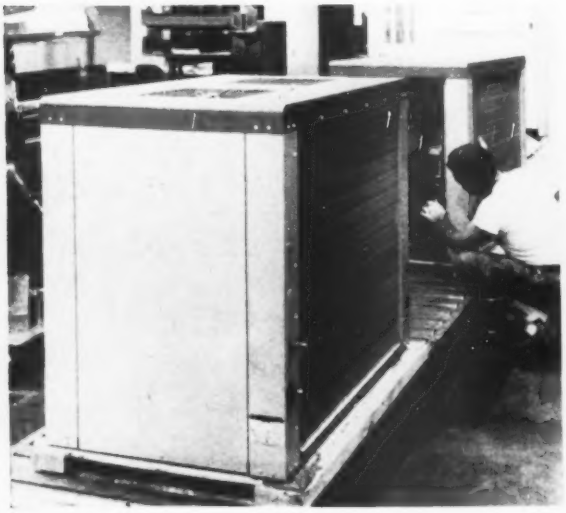


Corner Support

(5) *A. B. Chance Co., Centralia, Mo.*

A device for supporting three-conductor aerial cable in a triangular configuration at corners is offered by this company. It is used when the corner angle exceeds 10° for large conductors or 25° for small conductors. It provides 7 in. of uniform air space between any two conductors.

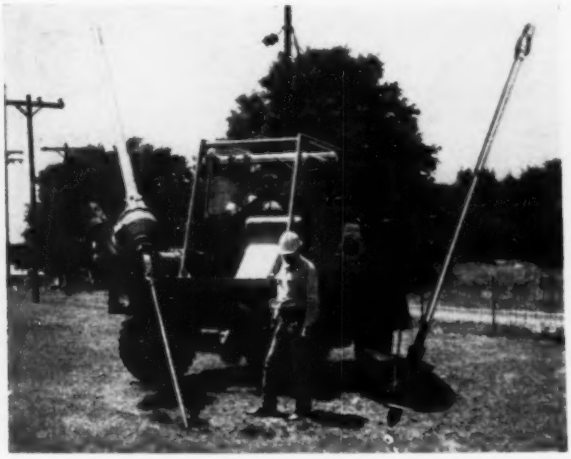
Five 195-ft-long standards, believed to be the world's tallest poles for floodlighting, are shown leaving for San Francisco's Candlestick Point Stadium from the yard of Weld-Rite Co. in Oakland. Five flat cars were required for the load, which was reported by Southern Pacific Railroad to be the longest material ever handled by rail in the Bay area



Five-Ton Heat Pump

(6) *Westinghouse Air Conditioning Division, Box 510, Stauton, Va.*

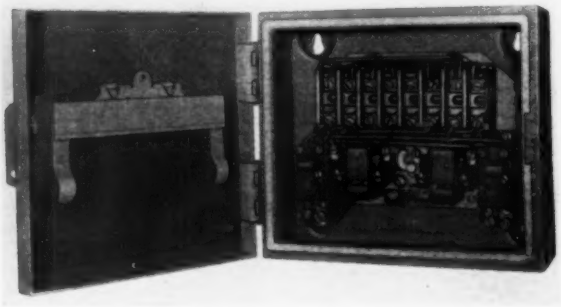
A new air-to-air five-ton heat pump has been announced by this company. The unit complements the manufacturer's heat pump line, consisting previously of 3- and 7½-ton units. It is the first of the line to be equipped with a control system that senses oudoor temperatures and regulates indoor temperature accordingly. It is reported that this compensates for faster heat transfer during intervals of greater temperature differential between inside and outside and eliminates the need for manual adjustment of room thermostat setting when the outdoor temperature changes. The unit has separate indoor and outdoor sections.



Screw Anchors

(7) *A. B. Chance Co., Centralia, Mo.*

A new line of power-installed screw anchors offered by this company is designed to be installed with the power hole diggers used by utilities for line construction. Complete installation requires five to eight minutes, according to the company, and they can be installed in all types of soil except extremely rocky ones. The anchors are adapted to power equipment by means of a special installing wrench that is purchased separately from the company. It fits over the anchor and carries the installation torque.



Magnetic Motor Starter

(8) *Clark Controller Co., 1146 E. 152d St., Cleveland 10, Ohio*

Availability of a new magnetic reversing, across-the-line squirrel cage motor starter, size 00, 600 v maximum, three phase, is announced by this company. It is designed to provide full voltage starting and reversing of squirrel cage motors. One model includes two thermal overload relays for removing the motor from the line in the event of an unsafe overload. Both models have two mechanically interlocked three-pole contactors, each with normally open control circuit interlock.

GOOD NEWS in aluminum construction . . .

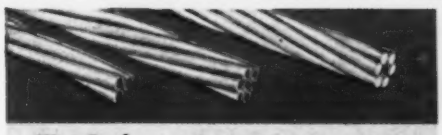
ALUMOWELD

Aluminum-Covered Steel Wire and Strand

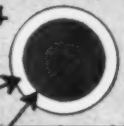
Alumoweld was developed to cut costs and improve performance of overhead ground wire, ACSR conductors, guy and messenger strand. Its thick aluminum covering —25% by area—gives Alumoweld corrosion resistance equal to solid aluminum wire and 33% of the electrical conductivity.

When used as overhead ground wire, remember that Alumoweld is just as strong as steel, is 18% lighter in weight, and has 3 times the conductivity. These advantages permit greater mid-span clearance, and make Alumoweld excellent for relaying and for discharging lightning currents to ground. For guys and messengers, Alumoweld Strand provides the full strength of steel and will last far longer.

These valuable properties also pay off when Alumoweld is used as core wire for ACSR conductors. Here, Alumoweld eliminates the hazard of dissimilar metals in contact, provides increased conductivity and gives you an extra-high-strength core wire that matches the life of the solid aluminum wires. For the complete story, send for Bulletin E.D. 3000.



Two Exclusive features of **ALUMOWELD**



Alumoweld's thick aluminum covering will never crack, flake or peel. Applied by an entirely new cladding process—the controlled atomic weld—the heavy aluminum covering and the high-strength steel core are inseparably interlocked by a ductile weld that remains permanent under all operating conditions.

COPPERWELD STEEL COMPANY

WIRE AND CABLE DIVISION, GLASSPORT, PA.

For Export COPPERWELD STEEL INTERNATIONAL COMPANY, New York

For phone number of closest representative see advertising index in back of book.

Earl S. Condon COMPANY

Engineering Representatives

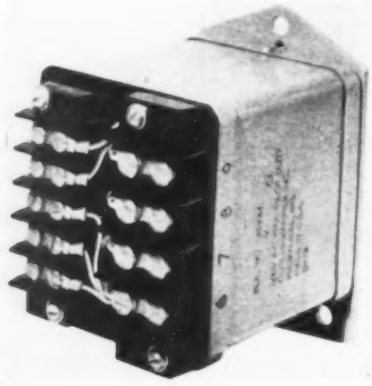
- *Burndy Corporation*
- *Kaiser Aluminum & Chemical Sales, Incorporated*
  (INSULATED ELECTRICAL WIRE PRODUCTS AND ALUMINUM CONDUIT)
- *Hughes Aircraft Company*
  (PRODUCTS DIVISION)
- *Lapp Insulator Co., Inc.*
- *Preformed Line Products Company*
- *Lotran, Inc.*

3450 Wilshire Blvd., Los Angeles 5, Calif.
Phone: DU 1-3951 · TWX: LA-795

Hot Line Tool

(9) *Aluminum Co. of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa.*

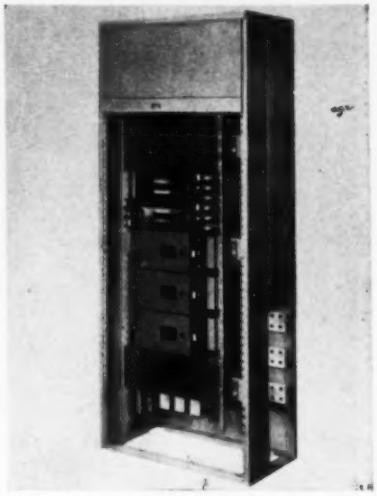
A device that permits hot line installation of standard parallel groove clamps is offered by this company. The tool in effect performs the functions of the mechanism of a hot line clamp, but can be removed after the parallel groove clamp is installed. The tool is operated by the hook of a hot line stick. Primary advantage is saving the extra cost of hot line clamps over parallel groove clamps.



Overtemperature Relay

(10) *Cutler-Hammer Inc., 234 N. 12th St., Milwaukee, Wis.*

A direct monitoring overtemperature relay device for use in a wide range of a-c applications has been developed by this company. It consists of a magnetic relay, two transistor amplifiers, a diode network for signal separation and a voltage regulated power supply. Though specifically designed to protect three-phase a-c motors, the features of the relay are said to make it suitable for use wherever overtemperature is a problem. The device responds only to the actual temperature of the protected equipment because the thermistor is inserted in the windings of the motor, generator or transformer. Power supply ratings are 110, 208/220, 440 or 550 v, 60 cycles.



Vertical Stacked Bus

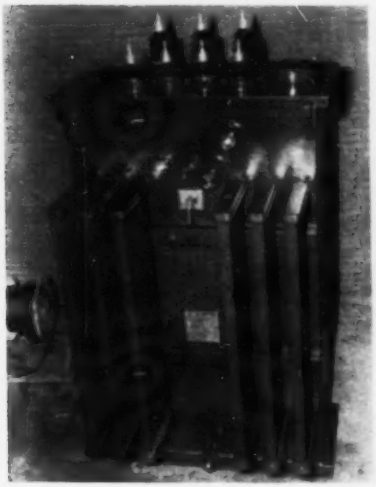
(11) *Square D Co., 4335 Valley Blvd., Los Angeles 32, Calif.*

Busing is stacked vertically in a new switchboard offered by this company. The bus is moved back and is completely out of the wiring area to provide unobstructed working space and to reduce wiring time. An optional location of the cross bar is possible and the need for bused riser sections to transfer cross busing to a top or bottom location is, in most cases, eliminated.

Lighting Swivel

(12) *Ward Engineering Inc., 6439 San Fernando Road, Glendale 1, Calif.*

UL listed for weatherproof applications, this company offers a new heavy-duty swivel for industrial and commercial lighting applications. The swivel has 360° rotation of the base and 180° adjustment of the lamp holder. Adjustment is with the fingers.



Substation Transformers

(13) *I-T-E Circuit Breaker Co., 1900 Hamilton St., Philadelphia 30, Pa.*

Specifications for its complete line of of power and distribution transformers have been announced by this company. The new line includes liquid-filled transformers (pictured) and both sealed and ventilated dry-type models for utility and industry applications for primary voltages up to 69 kv and for loads up to 12,500 kva. The line incorporates units formerly sold only with the company's substations plus new single-phase and higher voltage, higher capacity units.

Open Thimble Clevis

(14) *Hubbard & Co., 200 S. Michigan Ave., Chicago 4, Ill.*

A simplified method of making corner or dead-end conductor attachments is provided by this new open-side thimble clevis. The conductor is simply looped around the wire groove, eliminating the need for threading through the clevis. The deep groove is very smooth to prevent chafing of the conductor. The thimble is 2¼ in. in diameter and will accommodate strand or wire ¾ in. or under.

PVC
ROYALOK

Caps and Connectors interlock with a twist of the wrist . . . give you rugged, positive, fail-proof power connections.

Unbreakable molded vinyl bodies—can't crack, chip, or break . . hold blades and contacts solidly in place. Resistant to acid, oil, and grease.

Safer, stronger construction— Dead-front caps eliminate nuisance of fiber washers and dangers of exposed conductors. Internal barriers separate conductors. One-piece connectors have heavy brass double-wipe contacts locked in solid vinyl

ORDER FROM YOUR WHOLESALER, OR WRITE FOR CATALOG 2-58-4.

A Broad Line of ROYALOK Interlocking* Devices

2-Wire Polarized	3-Wire Polarized Grounded	4-Wire Grounded
10 Amp — 250V 15 Amp — 125V 20 Amp — 250V Dead-front caps . . . one-piece connectors	10 Amp — 250V 15 Amp — 125V 20 Amp — 250V 10 Amp — 600V Dead-front caps . . . one-piece connectors	20 Amp — 250V 10 Amp — 600V Dead-front caps . . one-piece connectors

*Fit all standard interlocking devices

QUICK, CLEAN WIRING 3 Simple Steps!

1. Remove cord grip plate by loosening plate screws (they can't fall out).
2. Insert cord thru clamp, strip conductors and connect to terminals.
3. Replace grip plate, tighten screws — that's all!

ROYAL ELECTRIC

ROYAL ELECTRIC CORPORATION

PAWTUCKET, RHODE ISLAND

...an associate of ITT

SALES REPRESENTATIVES AND WAREHOUSES: Los Angeles—1950 Naomi Avenue, RI 7-9655; San Francisco—1225 Sixth St., HE 1-5792; Seattle—4130 First Ave., So., MA 3-8882; Denver—888 S. Lipan Street, WE 6-3456

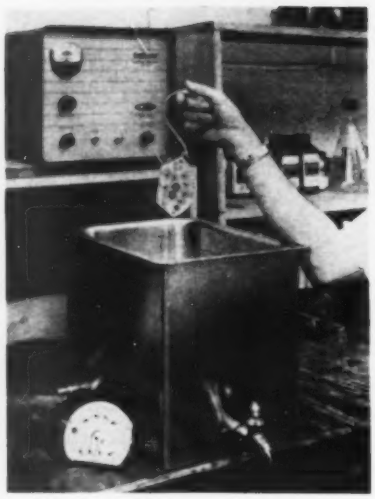
GALVANIZED STEEL STRAND FOR GUY, MESSENGER and OVERHEAD GROUND WIRE

The high, uniform, consistently-dependable quality of Crapo Galvanized Steel Strand is the direct result of close laboratory control over each step in manufacture. All wires used in forming a particular size and grade are produced from steel of selected analysis, carefully processed under technical supervision and stranded on precision machines. Both wire and finished strand are subjected to prescribed laboratory tests to insure the desired end result.

Heavy, uniform, tightly-bonded zinc coatings, applied by the famous Crapo Galvanizing Process, provide maximum resistance to corrosion.

Write for booklet OG-25 containing "Sag and Tension Data for Overhead Ground Wire."

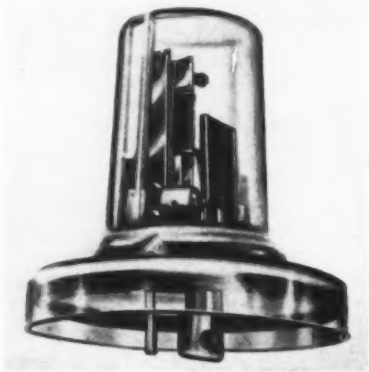
INDIANA
STEEL & WIRE CO., INC., Muncie, Indiana



Meter Cleaner

(15) *NARDA Ultrasonics Corp., 625 Main St., Westbury, L. I., N. Y.*

This company offers a new ultrasonic meter cleaner that utilizes a high frequency sound vibrator that throws millions of tiny bubbles through a water solution in the tank which, in turn, removes dirt and other foreign materials. The complete meter assembly is lowered into the cleaning tank.



Photoelectric Control

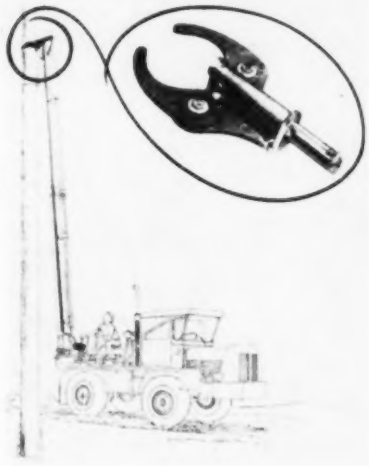
(16) *Precision Magnetic Controls Inc., Ridgewood, N. J.*

A tubeless photoelectric outdoor lighting control said to meet EEI-NEMA standards is offered by this company. Is is available in either 120 or 240-v models. The control is gasketed, has a polarized twist lock and built-in lightning arrester. The light-level setting is made directly on an integrating relay, without shading or shielding of the cell.

Conductor Connections

(17) *S&C Electric Co., 4435 Ravenswood Ave., Chicago, Ill.*

Two new types of conductor connections are offered with this company's 400-amp, 15-kv Loadbuster disconnect switches. This brings the total selection of connections to seven types. The two being introduced are compatible with aluminum and copper. All seven connection options are compatible with the terminal pad used on all Loadbuster disconnects. The two new connectors include (a) single-bolt, groove-type, solid bronze for No. 2 solid copper through 500-mcm stranded copper and (b) a two-bolt zinc-tin-plated aluminum alloy, groove type for No. 2 solid copper through 500-mcm stranded copper or aluminum.



Pole Aligner

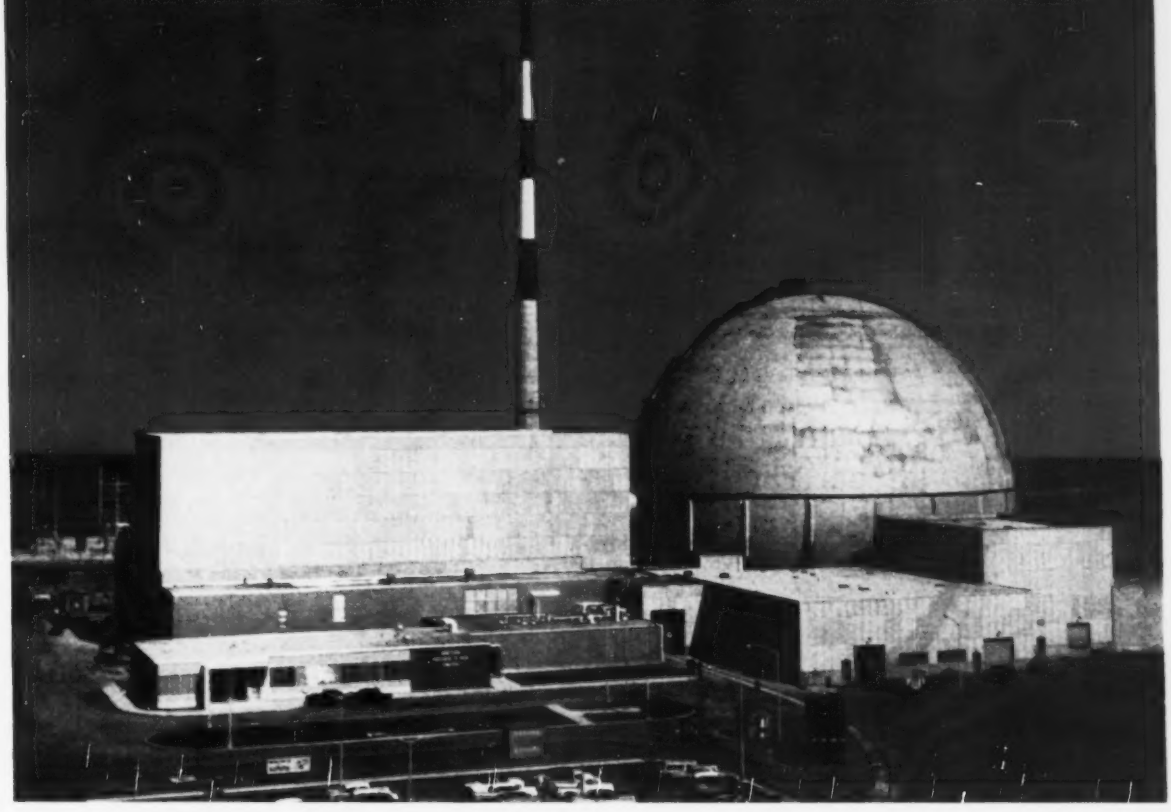
(18) *Galavar Corp., 2700 S. Broadway, Los Angeles 7, Calif.*

This new power-operated pole aligner consists of two pincer-type arms mounted on a steel platform at the derrick head sheave. The arms or pincers are hydraulically operated. Hydraulic line retracting system is available for telescopic booms. The complete system can be mounted on most derricks, cranes, booms and diggers. Finger-tip controls can be mounted anywhere.

For manufacturer's bulletins with additional information, fill in coupon on page 28.

DRESDEN*

...proves that nuclear power plant costs can be forecast
...will demonstrate the potential of low cost nuclear power



Dresden Nuclear Power Station—America's largest all-nuclear power plant—will be ready for initial test operations by General Electric Company in October, six months ahead of schedule and within original cost estimates. *Owned by Commonwealth Edison Company, the plant is located 50 miles southwest of Chicago.

Construction completion of the 180,000-kilowatt boiling water reactor plant marks an important step in the emergence of nuclear power into full-scale commercial use.

With Dresden proving that nuclear power plant costs can be predicted accurately, Bechtel now designs and constructs nuclear plants on a fixed price basis—*eliminating uncertainty.*

Eight companies comprising Nuclear Power Group, Inc., contributed $15 million toward the total research and development costs: American Electric Power Service Corp., Bechtel Corp., Commonwealth Edison Co., Central Illinois Light Co., Illinois Power Co., Kansas City Power & Light Co., Pacific Gas & Electric Co., Union Electric Co.

As engineer-constructor for General Electric Company, the prime contractor, Bechtel performed plant design, detailed engineering, procurement and construction.

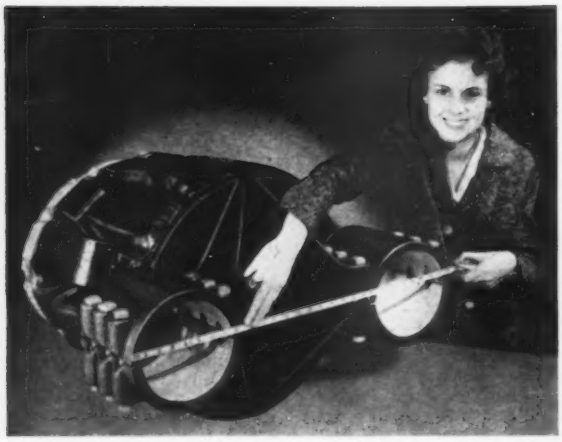
BECHTEL

BECHTEL CORPORATION

Engineers and Builders for Industry

SAN FRANCISCO • Los Angeles • New York • Houston

CANADIAN BECHTEL LIMITED • Toronto



Large Flexible Connector

(19) *H. K. Porter Co. Inc., Delta-Star Electric Division, 17th & Cambria Sts., Philadelphia, Pa.*

What are reported to be the largest all-aluminum flexible connectors for an 11,000-amp. 19-in. diameter tubular aluminum bus have been produced by this company. Each unit measures 28 in. in length and 28 in. across the two terminal taps. They are being used on what is said to be the highest ampere generator bus installation ever built. All welded construction, except for transformer lead connections, provides a minimum of current interchange surfaces. A short section of aluminum bus welded into the connectors helps facilitate field installation.

Plastic Hot Stick Container

(20) *B. F. Goodrich Chemical Co., 714 W. Olympic Blvd., Los Angeles 15, Calif.*

Vinyl plastic pipe is presented by this company as a new, safer container for hot sticks. Use of the vinyl plastic results in less abrasive contact between the sticks and the container and eliminates the possibility of picking up bits of rust and flaked galvanizing that would be potential conductors.

HOW RELIABILITY IS BUILT INTO THE MAGNE-VALVE ARRESTER

by R.W. FRAHM—Manager of Lightning Arrester and Cutout Marketing

Every General Electric Magne-valve arrester is subjected to exacting factory tests to assure high mechanical and electrical strength.

Each Thyrite* valve element disk receives multiple impulse discharges to stabilize and measure its discharge voltage characteristics. Each assembled unit receives a production line 60-cycle sparkover test and a test to assure freedom from radio noise. A vacuum test ascertains the arrester housing's ability to seal out atmospheric moisture. Thus, each functional element of the arrester is separately checked. Units which fail to measure up in any area are immediately rejected.

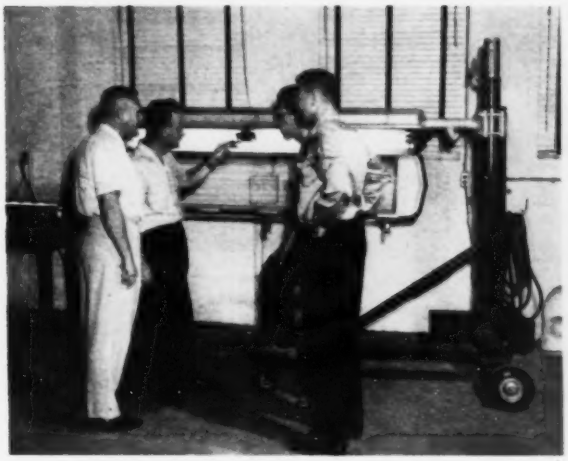
Field experience has proven that these tests provide you with the best distribution arrester available. Since 1953, when General Electric introduced the first magnetic gap controlled distribution arrester, 1,300,000 arrester years of near-faultless service have been compiled—substantial evidence that quality and reliability are built-in features of every G-E Magne-valve arrester.

We'd like to tell you more about our complete line of distribution arresters. Contact your General Electric representative or write Section 435-21, General Electric Co., Schenectady, N. Y.

*Registered trademark of General Electric Co.

GENERAL ELECTRIC

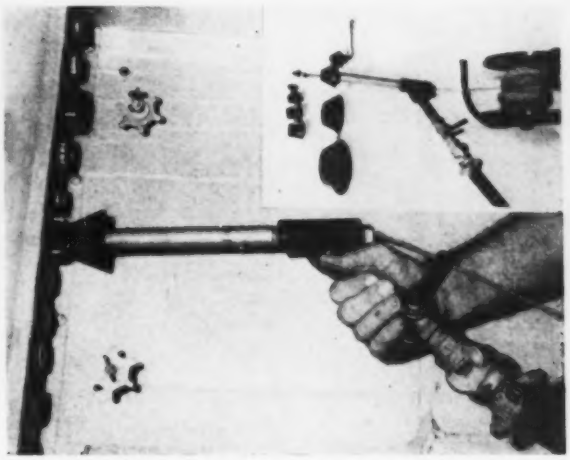
Exacting factory tests assure



Heat Pump for Luminaire

(21) *Line Material Industries, 700 W. Michigan, Milwaukee 1, Wis.*

This company announces a new four-lamp fluorescent luminaire that is equipped with a thermoelectric heat pump. The company reports that the light output of the luminaire at 77 F ambient temperature is 72% higher than for the same luminaire without a cooling device. The light output is said to be constant through an ambient temperature range of below 0 F to over 77 F. Shown with the new luminaire, left to right, are C. C. Allen, Los Angeles; P. B. Clark, chief engineer for outdoor lighting; Bruce V. Kunde, San Francisco; and A. C. Genor Jr. of Spokane.



Conduit Threader

(22) *Sam the Electrician Inc., 14346 Lakewood Blvd., Bellflower, Calif.*

A kit for blowing a cord, wire, rope or cable through all sizes of conduit, even from outlet box to outlet box, is available from this manufacturer. Distance is limited only by the length of "leader" used, according to reports. Compressed air is the propelling force. The device, which is also used by the manufacturer, has saved as many as 104 hours on one job, he reports.

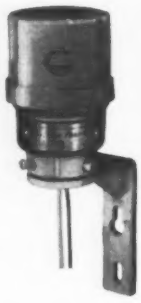
the reliability of General Electric

Magne-valve distribution arresters

GENERAL ELECTRIC

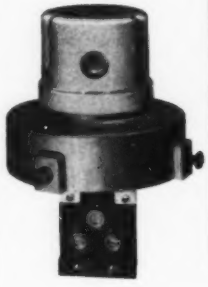
Luminaire or slipfitter mounting, bases up to 3" diam. . . . Model 6600A. (For bases up to 3¼" diam. . . . Model 6607A)

Pole or crossarm mounting . . . Model 6601A



Replacement plug-in for F-P Model S-64400 . . . Model 6604A. (Also, Model 6603A replacement for F-P Model S-64400GE.)

Ornamental pole top mounting . . . Model 6600A with S-485 adapter (adapter also available for poles with I. D. less than 3")



Bracket mounting . . . Model 6600A with S-487 clamp assembly.

FISHER-PIERCE 6600A PHOTOELECTRIC CONTROLS

no mounting problems here...

You can put Fisher-Pierce 6600A Series controls *into* service quickly, easily and safely in almost any location — and they'll *stay* in service for years of maintenance-free operation. *Directional operation* and *delayed circuit response* provide uniform turn-on, protection against accidental turn-off; *built-in expulsion-type arrestor* protects control against surges and lightning; *broad area hermetically sealed CdS cell* is pre-aged and 100% inspected against rigid specifications; *circuit design conservatively derates* all components; *twistlock plug, base dimensions and sealing means* conform to EEI-NEMA standard for twistlock adaptations; all Series 6600A controls are *unconditionally guaranteed for two years.*

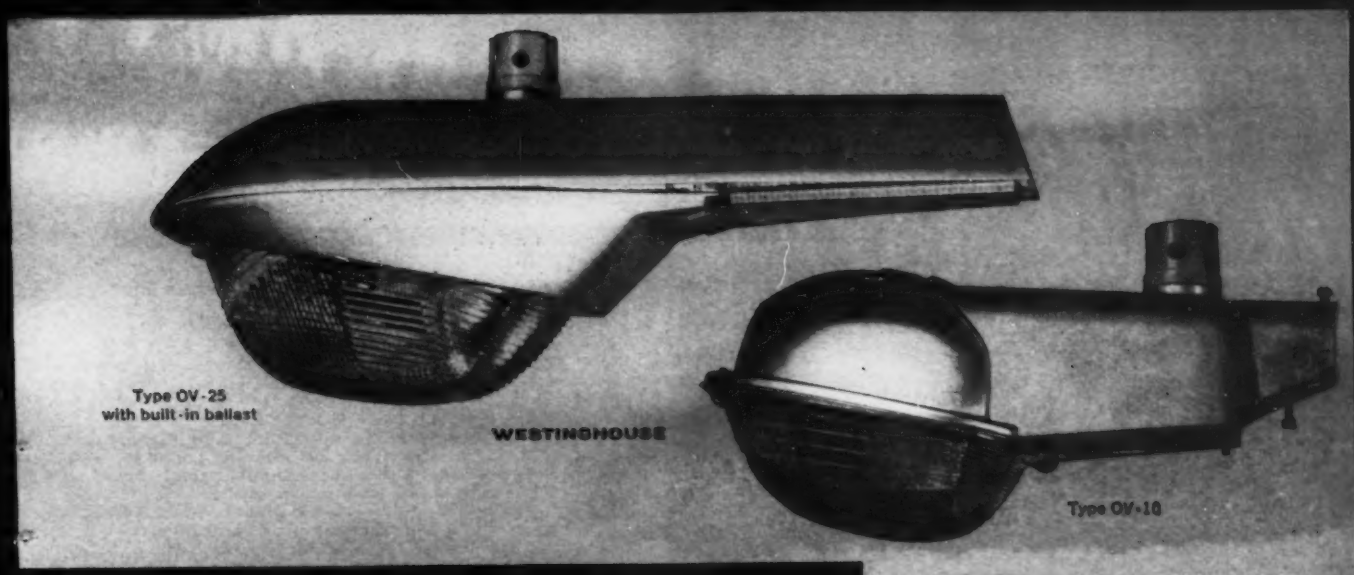
For complete descriptive details, write for the 8-page Detailed Technical Bulletin, no. FP-830. The Fisher-Pierce Co., 43 Pearl St., So. Braintree 85, Mass.

FP

FISHER PIERCE

PHOTOELECTRIC LIGHTING CONTROLS

AN AFFILIATE OF SIGMA INSTRUMENTS, INC.

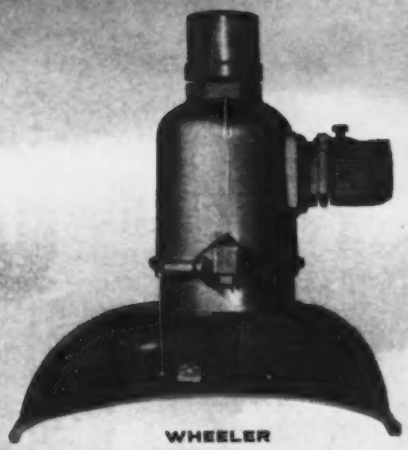


Type OV-25
with built-in ballast

WESTINGHOUSE

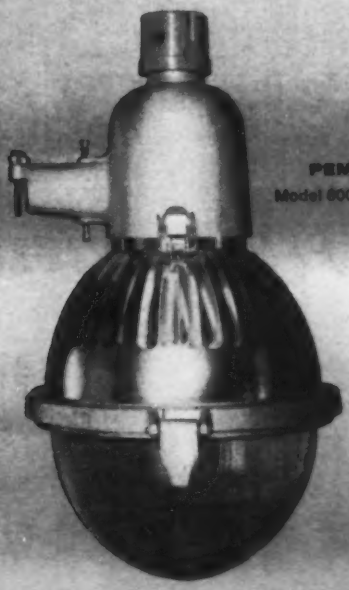
Type OV-10

Model 6600A
Actual Size

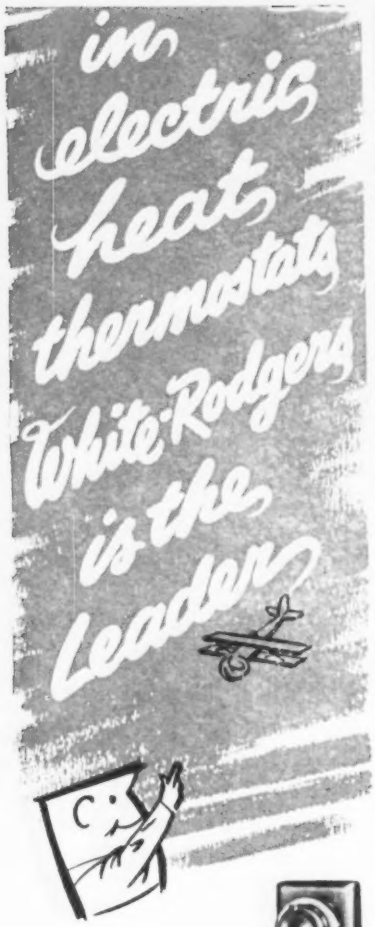


WHEELER
Crescent Luminaire

JOSLYN
Model J152278C



PEMCO
Model 600530H-08



Use them with confidence—they're specifically designed for Electric Heat by White-Rodgers—world's largest maker.

Sold under the brand names of more than fifty manufacturers of quality electric heating equipment.

Type 1A61
World's Largest Seller

Type 1A65
Elegant New Companion

WHITE-RODGERS CO.
ST. LOUIS 6, MISSOURI
PORTLAND 12, OREGON
2846-52 N. E. Glisan
LOS ANGELES 26, CALIFORNIA
201 Glendale Blvd. 224W

BULLETINS ETC.

(23) FUSE CATALOG—Bulletin 1320, a 12-page catalog covering the complete line of Economy Renewable fuses manufactured by Federal Pacific Electric Co., 50 Paris St., Newark 1, N. J., has just been published. Presented are construction and application features and information and specifications on the 250-v and 600-v fuses.

(21) UNDERFLOOR SYSTEMS—Materials for underfloor electrical distribution systems, such as duct, junction boxes and fittings, are illustrated in catalog No. 35, now available from Walker Brothers, Conshohocken, Pa.

(25) CODE GUIDE—Columbia Cable & Electric Corp., 255 Chestnut St., Brooklyn 8, N. Y., is offering a wallet size card carrying the National Electrical Code Guide. Available free upon request.

(26) MOTOR CLEANING—Full information on the application of Freon solvents to the cleaning of electric motors is available from E. I. Du Pont De Nemours & Co., 8531 Nemours Bldg., Wilmington, Del. The company forecasts savings of as much as 75% on large motors through on-site use of nonflammable, nonexplosive and virtually nontoxic Freon solvents.

(27) CASE HISTORY—Pfaff & Kendall, 84 Foundry St., Newark 5, N. J., is offering a case history study of the street lighting experience of the resort town of Asbury Park, N. J.

(28) CATALOG SHEETS—Updated catalog sheets for Electromagnetic Control Catalog 57-S published by Automatic Switch Co. are now available. Write to the company at Florham Park, N. J. Ask for ASCO Kit 57-SAK.

(29) DATA CHART—Hatfield Wire & Cable Division, Hillside, N. J., is offering data charts printed on cards and color coded for quick identification that carry prices and specifications of the company's electric wires, cable and power cords. Address your request to Department EW, Hillside 5, N. J.

(30) HELICOPTER USE—Line patrol, construction and right-of-way maintenance by helicopter are among topics covered in a booklet recently released by Hiller Aircraft Corp., 1350 Willow Rd., Palo Alto, Calif. Ask for "New Workhorse for Utilities."

(31) HEADERDUCT—A new bulletin describing two new Headerduct underfloor wiring systems for use with cellular steel floor construction is available from National Electric Division, H. K. Porter Co. Inc., Porter Bldg., Pittsburgh 19, Pa.

(32) CONDUCTOR STRINGING—Sherman & Reilly Inc., First & Broad Sts., Chattanooga 2, Tenn., has produced a new 16-page catalog with illustrations and specifications on many new items for conductor stringing, such as utility snatch blocks, pole mounted bracket, aerial and cable blocks.

KILL TWO BIRDS WITH ONE STONE—Fill out this coupon and get back valuable information from as many sources as you indicate.

ELECTRICAL WEST
68 Post St., San Francisco 4, Calif.

Not good after December 1

Please send me, without obligation, the new product information or catalogs

If described in Product News, circle item number

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

If described in advertising, fill in page number

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

NAME TITLE

COMPANY

ADDRESS

CITY ZONE STATE

*Please include your company's name and your position, as we cannot ask manufacturers to furnish literature unless you do.

Note how ordinary EMT split early in pressure test while induction welded CIRTUBE EMT (shown here unplated) held fast, surpassing UL requirements.

BETTER WELDING

on new CIRTUBE EMT means easier, split-free bending

THERE are many reasons why new CIRTUBE EMT will help you get faster, cleaner wiring jobs. Most of them are listed here.

One *big reason*, however, is *continuous induction welding*—by far the best technique available for making bead-free, split-free welds on high quality EMT.

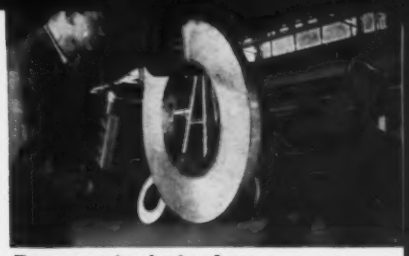
It is virtually impossible to split an induction-welded EMT no matter how severe the bends. And the perfectly clean weld means uniform roundness—easier, neater bending without the slightest kink or flattening. Your men get it right the first time around.

Try induction-welded new CIRTUBE EMT soon as you can. Your wholesaler has it now—bundled with distinctive orange colored tape to identify the EMT manufactured to Circle's quality standards.

CIRCLE WIRE & CABLE
a subsidiary of CERRO DE PASCO CORPORATION

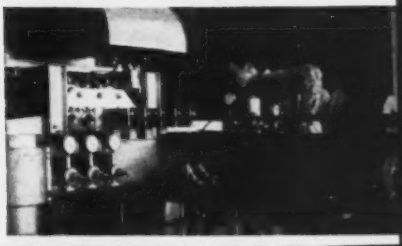
PLANTS: Maspeth and Hicksville, N. Y. **SALES OFFICES & WAREHOUSES:** In all principal cities
RUBBER COVERED WIRES & CABLES • VARNISHED CAMBRIC CABLES • PLASTIC INSULATED CABLES
NEOPRENE SHEATHED CABLES • "CIRTUBE" EMT

CIRTUBE EMT *Ask for it!*



Proper steel plus! The best cold rolled steel plus the right handling give CIRTUBE EMT its natural bendability.

Easy fishing! A baked-on protective coating gives CIRTUBE EMT a built in lubrication for easier wire pulling.



Lifetime exterior finish! Hard galvanized finish for durability; polished satin lustre for lasting good looks.

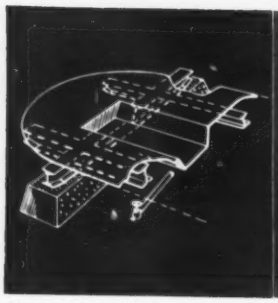
Automated quality control! Automatic controls assure complete and continuing uniform quality of product.

Tight, easily handled bundles! Bright, orange tapes hold CIRTUBE EMT securely for easy handling on and off the job.

Fast, friendly service! Well-known Circle service through a nation-wide network of well stocked nearby warehouses.

NEW Allis-Chalmers small power transformers install for less...

LIGHTER! LOWER!

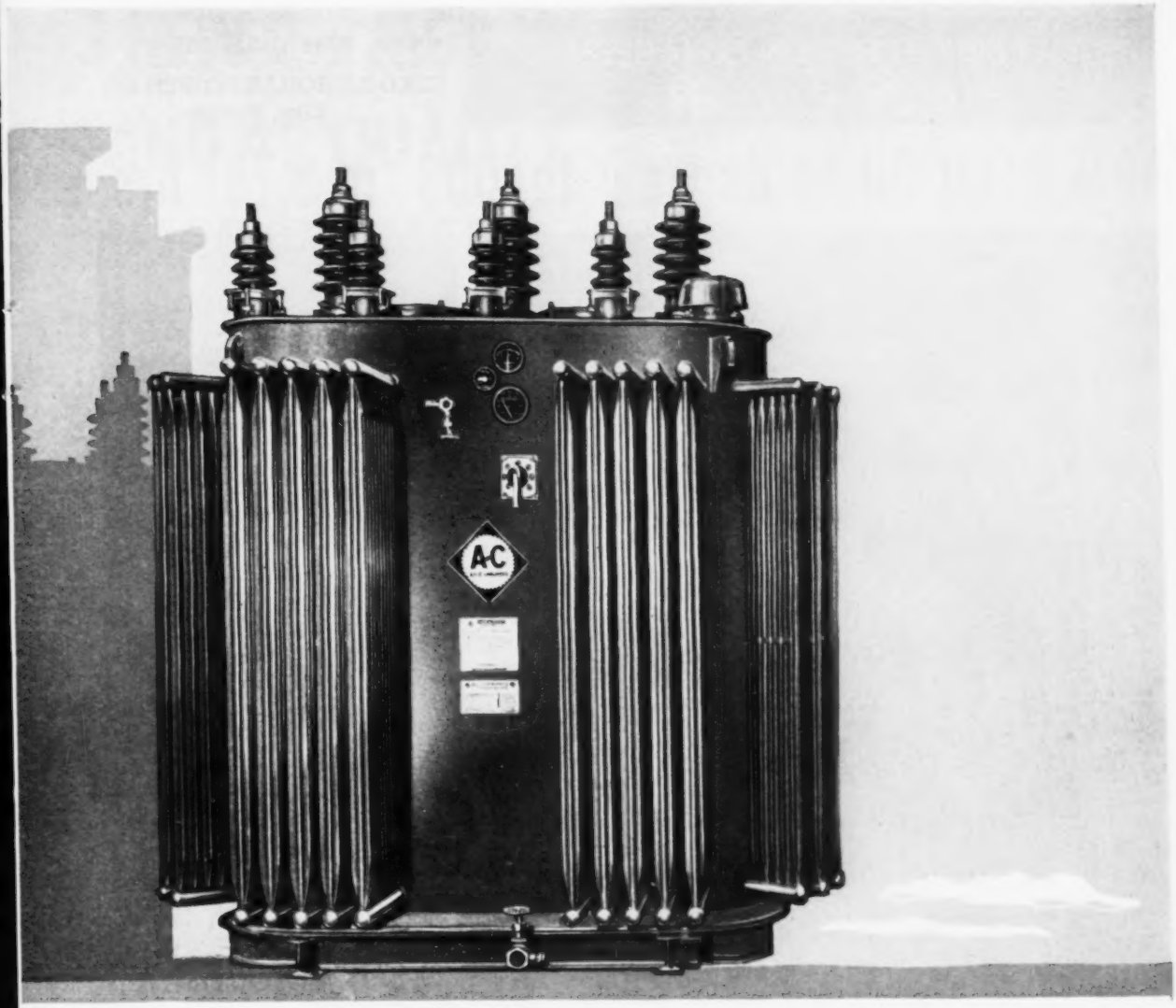


New base design permits mounting on smaller pads, low-cost piers or concrete planks.

Grouped instrument arrangement at convenient height for easier reading.

Self-resetting mechanical relief device automatically resets and re-seals after operation.

Simplified hand-hole covers use only 5 captive "J" bolts instead of 14 loose nuts.



BY 30%!

- **Slashes installation costs**
- **"Hide-away" design** with lower profile
- **Instruments grouped** for operator convenience
- **Base designed** for pier or pad mounting
- **Cleaner appearance,** easier to maintain — no external bracing

ALL new—lower, lighter too!

How's this for weight savings? The 34.5-kv, 3750-kva transformer, for example, is now 8000 lbs. *lighter* than its predecessor . . . brings big savings in handling and pad costs. Losses, exciting current and noise level are also reduced.

Easier servicing! Base sump collects any contaminant, removing it from active oil, permits sampling and draining at very bottom. Tap changer easily operated from ground level. Unit is reinforced from *inside* — smooth, clean appearance — no external bracing.

There's more savings to this A-C story. Get the details at your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-C

A-1178-E

For phone number of closest representative see advertising index in back of book.

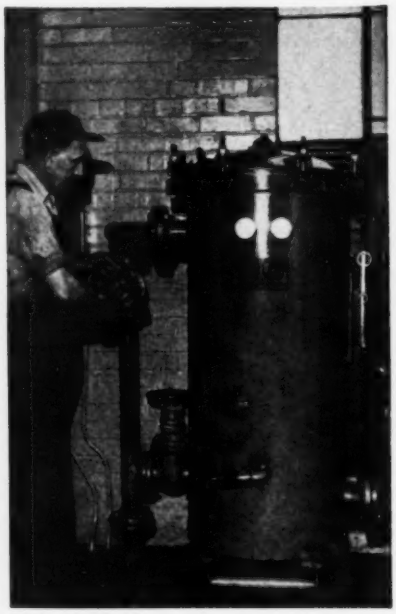
STANDARD ENGINEER'S FIELD REPORT

PRODUCT RPM DELO OIL

FIRM ELKO LAMOILLE POWER CO. Elko, Nevada

RPM DELO Oil holds wear to .003" in 9,791 hrs.

In initial operation, this 2,045-hp Enterprise diesel lubricated with RPM DELO Oil ran continuously for 9,791 hours. Average wear on engine's eight 17" diameter cylinders was just .003"! Plant Manager Hugh Liparelli says, "Frankly, the clean condition of the pistons and liners surprised me. I expected them to be coated with varnish, but instead we found them bright and shiny. The engine looked as if it had only run about 2,000 hours. There were no stuck rings, no engine deposits of any kind." The engine drives a 1450 KW generator at Elko Lamoille Power, went into service in 1954.



Hilco oil filter for Enterprise diesel operates whenever engine is running, helps keep oil clean, permits longer continuous operation. RPM DELO Oil, the only lubricant used in this engine, is also used in cylinder lubricators of station's five other diesels. Elko Lamoille Power Co. has used RPM DELO OIL since its introduction.

Why RPM DELO Oils reduce wear—prolong engine life

- Oil stays on engine parts—hot or cold, running or idle
- Anti-oxidant resists lacquer formation
- Detergent keeps parts clean
- Special compounds prevent corrosion of bearing metals
- Inhibitor resists crankcase foaming.

For More Information on this or any other petroleum product contact your Standard Engineer or representative, or write 225 Bush Street, San Francisco 20, California.

LUBRICATING OILS RPM DELO

TRADEMARKS "RPM DELO" AND CHEVRON DESIGN REG. U.S. PAT. OFF.

STANDARD OIL COMPANY OF CALIFORNIA

3 NEW G-E MOTORS AND 42 QUALITY IMPROVEMENTS

A family appearance in power station motors and 42 basic design improvements are now available from General Electric. The three new enclosures shown here enable electric utilities to select power station motors with the same modern appearance. And all of these new motors contain the same advanced features, painstakingly engineered to meet electric utility standards of reliability.

Among the 42 quality improvements available on all G-E boiler feed pump motors, are:

- **Polyseal* insulation system**—sealed against moisture; resists fly ash, most other abrasives.
- **Patented tying system**—heat hardened Permafil glass rovings hold end turns of form wound coils in a vise-like grip for maximum support.
- **Rugged frames**—provide added rigidity and strength required for power station service.
- **Extremely low noise level**—now possible with proven acoustic treatment.
- **Stator connections**—all brazed for more uniform strength, reliability.
- **Controlled slot wedging**—provides tight, stable fit, virtually eliminates coil looseness and resultant wear.

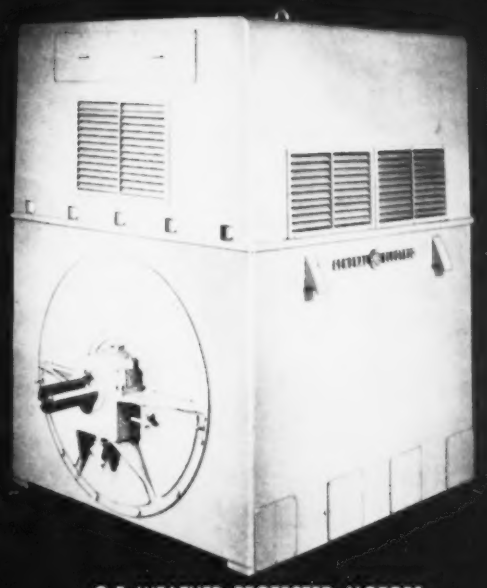
FOR THE COMPLETE STORY on G.E.'s 3 new power station motors and 42 quality improvements, contact your G-E Apparatus Sales engineer or write Section 884-3, General Electric Co., Schenectady 5, New York.

*Trademark of General Electric Co.

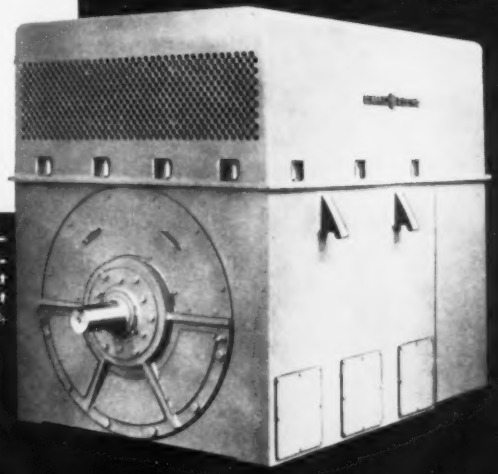
Progress Is Our Most Important Product

GENERAL ELECTRIC

BOILER FEED PUMP MOTORS—
Large 2-pole dripproof motors are acoustically treated for quiet operation—give long, reliable service.



G-E WEATHER PROTECTED MOTORS—
give better protection against rain, snow—even hurricanes—exceed NEMA Type II definition.

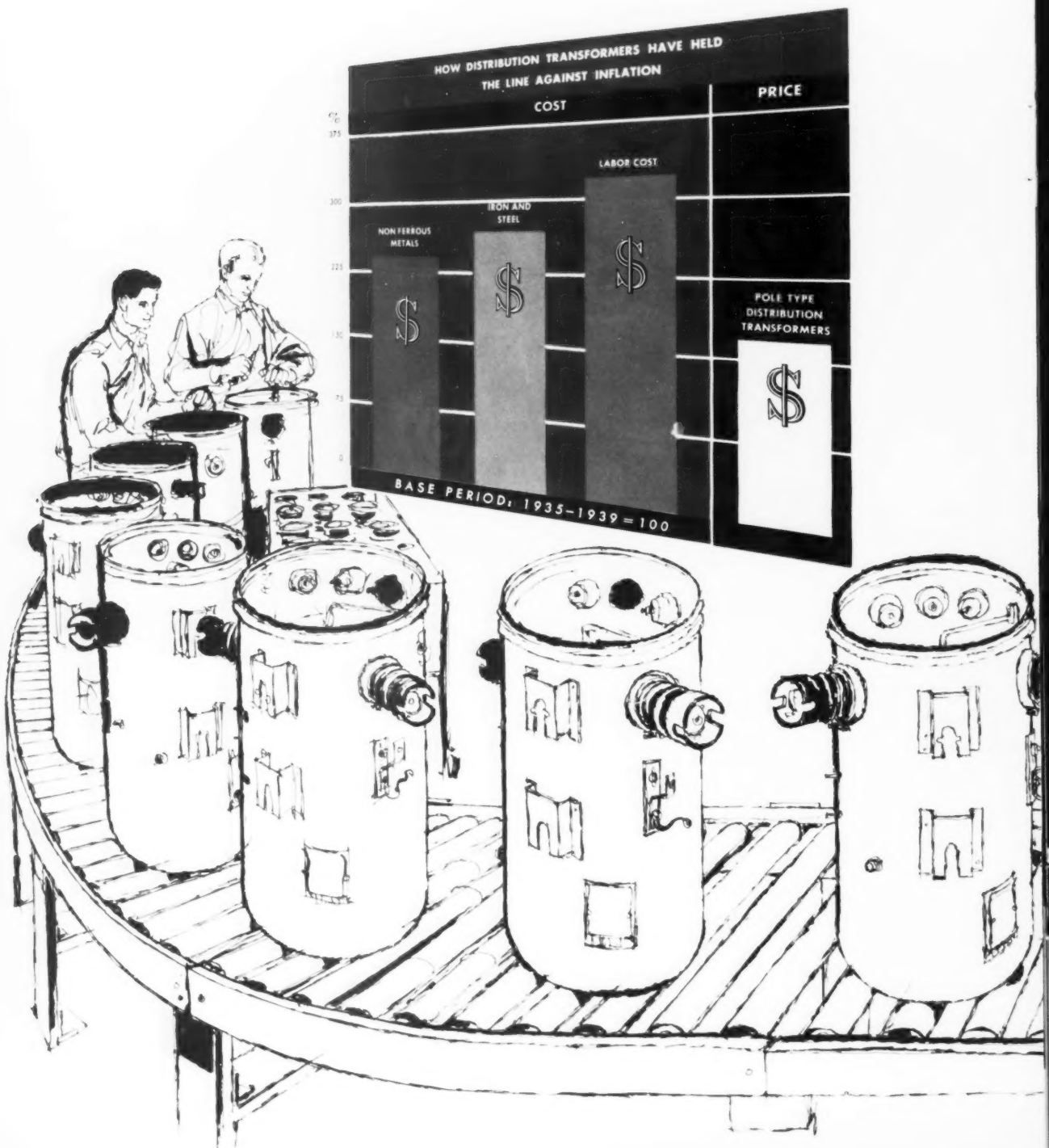


G-E TUBE-COOLED TEFC MOTORS—
are designed for easy disassembly, maintenance and inspection; computers select optimum number, size and arrangement of tubes for most effective ventilation.

another G-E PROJECT '8000' development

PROJECT '8000'—
a major General Electric program of research, product redesign, advanced manufacturing and improved customer service on a-c motors 150- to 6000-hp.

Before you buy another



transformer... ANALYZE PRICE

General Electric keeps price down with standardization, volume, product innovation

Using the period from 1935 to 1939 as the base, nonferrous metals are up 139%, iron and steel up 174%, and labor is up 234%. Yet G-E pole-type distribution transformers are now up only 59%.

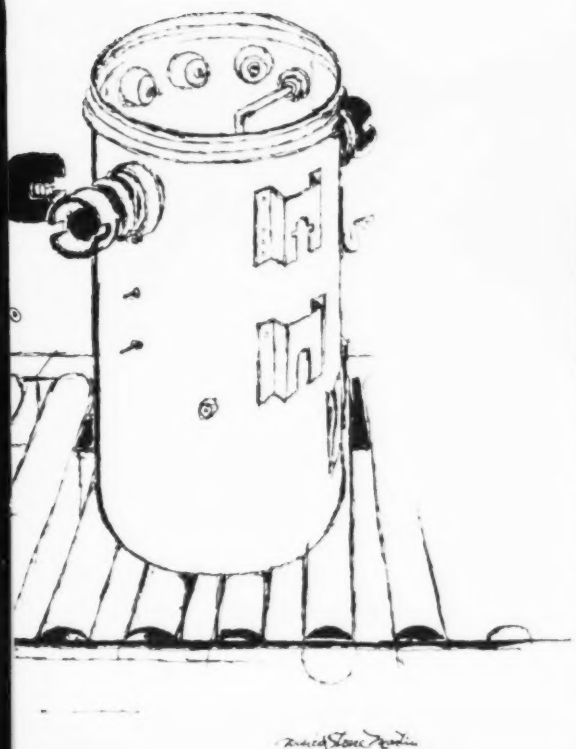
The cost of transformers remains comparatively low thanks in part to your increasing number of large-volume orders and to your support of standardization programs. Both contribute importantly to economical mass production.

Product innovations have also helped keep transformer prices down. General Electric's $1,000,000 development of grain-oriented strip steel, for example, has resulted in an estimated saving of over $300,000,000 to utilities since the steel was introduced twenty years ago.

Before you buy another distribution transformer, analyze price—give your transformer manufacturer credit for the extra values he gives you. General Electric Company, Schenectady 5, New York. 431-82

Progress Is Our Most Important Product

GENERAL ELECTRIC



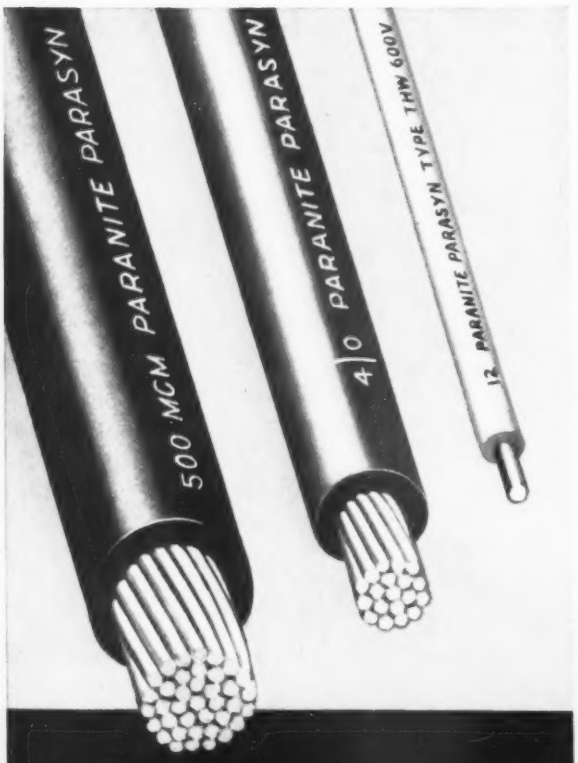
GIVE YOUR TRANSFORMER MANUFACTURER CREDIT FOR THE EXTRA VALUES HE GIVES YOU

		G.E.	OTHER MFRS.			
MEASURE LOAD BUILDING—do Co.'s other products build load? Does Co. sponsor load-building programs?						
CHECK SERVICE—24-hour shipment? repair and uprating? emergency assistance?						
COMPARE FEATURES—how many exclusive features in terms of longer life; reliability; easy maintenance?						
ANALYZE PRICE—does Co. hold line against inflation with significant product developments?						
EVALUATE INNOVATIONS—has Co.'s research paid off for you? Recent examples?						

FILL IN THE BLANKS . . . See which manufacturer gives you more for your transformer dollar: Mark "X" for a measurable contribution, "O" for insignificant contribution.

PARANITE THW and RHW

Two types available for 75°C wet or dry specified applications



NEW! PARASYN® TYPE

THW

THERMOPLASTIC INSULATED 600 V BUILDING WIRE

New UL listed 75°C building wire for wet or dry applications. Specially formulated Paranite vinyl insulation. Small diameters, slick silicone finish, color availability and stripping ease all contribute to reducing handling costs!

MYLAR TAPED* PARATEMP® TYPE

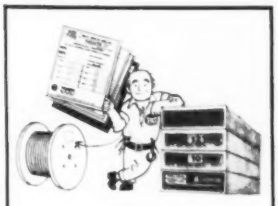
RHW

600 V BUILDING WIRE

Taped with * Dupont "Mylar" (AWG 6 and larger) to provide an improved moisture barrier with higher dielectric strength. Resulting diameter reductions, better fit conduit. Saturated and impregnated, braided sheath, lubricated with special waxes to reduce pulling resistance.

Both UL listed 75°C wet or dry location

Here are two improved building wire products—both offering you outstanding performance in similar installations. Standard colors available from stock in both solid and stranded, sizes 14 AWG through 500 MCM for the THW . . . and 14 AWG through 1000 MCM for the RHW. Get acquainted with advantages of both wires—write today for complete technical information!



Each Carton packaged to reduce handling and labor cost with color-coded labels plainly showing type, size and color of wire. Also, new reel cards for instant identification and inventory control.

PARANITE WIRE AND CABLE DIVISION

Essex Wire Corporation, Marion, Indiana

Sold only through recognized electrical distributors

MANUFACTURING PLANTS: Marion, Ind.; Jonesboro, Ind.; Tiffin, Ohio; Anaheim, Calif.

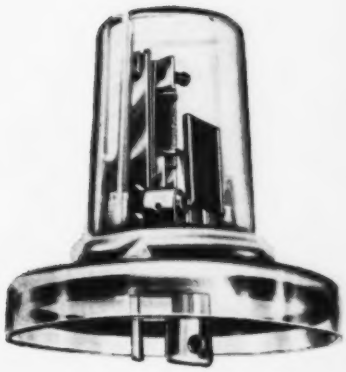
Sales Offices and Redistribution Warehouses in all Principal Cities

For phone number of closest representative see advertising index in back of book.

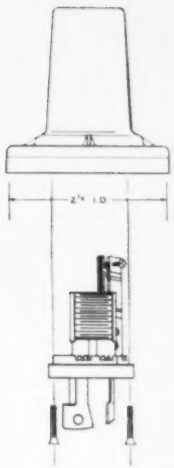
THE FIRST AND ONLY

2 component

PHOTOELECTRIC OUTDOOR LIGHTING CONTROLS



2 components switch and cell



The field designed PMC control is rugged, dependable and inconspicuous. PMC engineers originated and pioneered the simplified tubeless photocontrol circuitry utilizing an integrating relay directly operated by a CdS photoconductive cell. Multi-component unreliability has been eliminated by PMC. Proven by more than 130,000 field installations.

FEATURES:

- Designed to EEI-NEMA Standards TDJ-148
- Large Area CdS Photoconductive Cell
- Component Protection — Lightning Arrester
- Small Size—Height 2 1/16", Base 2¾" I. D.
- Ambient Temperature Compensation — −40°F to +170°F
- Time Delay
- Tubeless
- Fail-Safe Operation

A complete line of Precision Photoelectric Lighting Controls is available in 120V or 240V models to meet your every need.

FOR COMPLETE TECHNICAL INFORMATION *write for* NEMA SPECIFICATION BULLETIN 459 AND FOR BULLETIN 460.

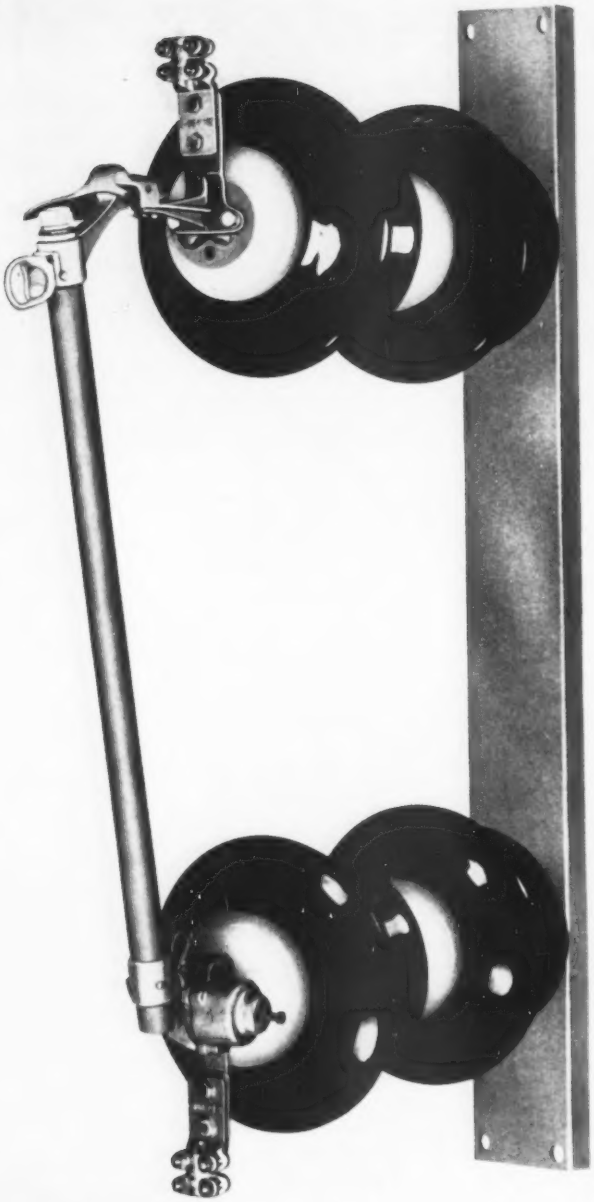
PMC

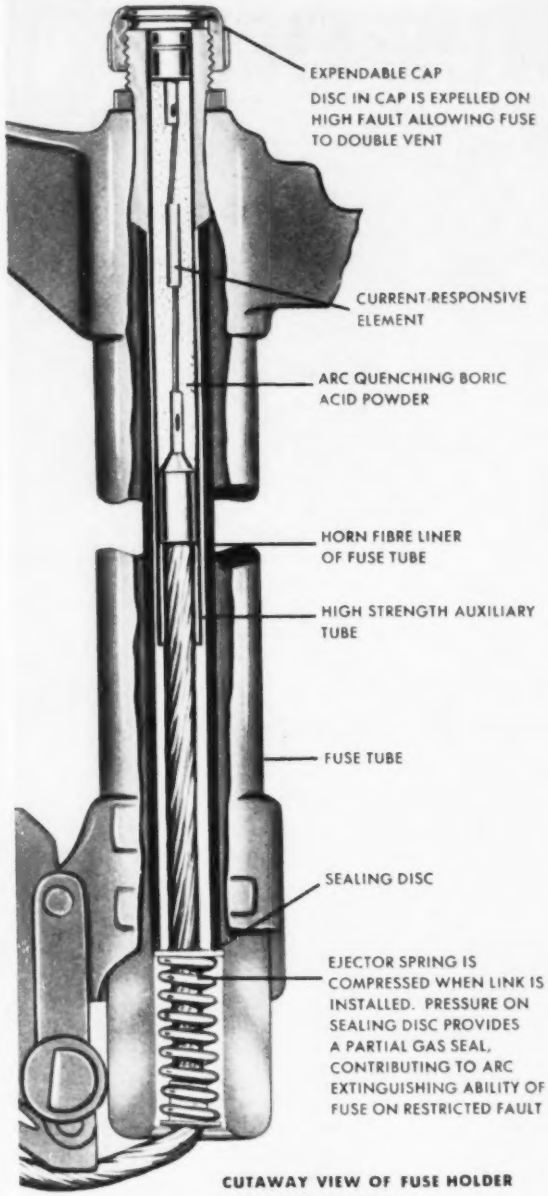
PRECISION MAGNETIC CONTROLS, INC.

233 CHESTNUT STREET, RIDGEWOOD, NEW JERSEY

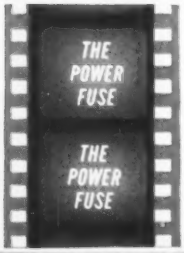
For phone number of closest representative see advertising index in back of book.

A Reliable New Family of




EXPENDABLE CAP
DISC IN CAP IS EXPELLED ON HIGH FAULT ALLOWING FUSE TO DOUBLE VENT
CURRENT-RESPONSIVE ELEMENT
ARC QUENCHING BORIC ACID POWDER
HORN FIBRE LINER OF FUSE TUBE
HIGH STRENGTH AUXILIARY TUBE
FUSE TUBE
SEALING DISC
EJECTOR SPRING IS COMPRESSED WHEN LINK IS INSTALLED. PRESSURE ON SEALING DISC PROVIDES A PARTIAL GAS SEAL, CONTRIBUTING TO ARC EXTINGUISHING ABILITY OF FUSE ON RESTRICTED FAULT

CUTAWAY VIEW OF FUSE HOLDER AND LINK ASSEMBLY



Don't miss this sound movie in full color..."The Power Fuse"

It is available, without cost, for viewing by anyone interested in power fuses. On-the-spot results of field tests conducted in conjunction with a leading utility. Factual, informative, well worth your time. Contact your Southern States representative to arrange a showing, or write direct to the company.

Power Fuses by Southern States

- POSITIVE CLEARANCE OF RESTRICTED FAULTS
- HIGHEST INTERRUPTING RATINGS AVAILABLE
- WIDEST RANGE OF SELECTION
- SIMPLIFIED CONSTRUCTION

Reliable performance—to provide dependable protection against high or low fault currents—is one of the most important requirements demanded of power fuses by engineers. With this uppermost in mind, we developed our new family of power fuses.

Extra reliability in clearing restricted faults is provided by the new, dual-operating characteristics of the expendable cap and arc-quenching boric-acid fuse link.

Extra reliability in handling high faults is provided by the double-venting action, fibreglass tubes and other design features—resulting in interrupting ratings approaching 3½-million kva at 161 kv.

A wider range of selection permits adequate fusing without buying excessive interrupting capacity.

The expendable cap and the sealing disc at the lower end of the fuse prevent the entrance of moisture or extraneous matter. Patented electrostatic shielding eliminates corona damage. A built-in snubber brings the fuse holder to a cushioned, shock-free stop. All in all, this rugged new family of power fuses is engineered to provide completely reliable service for many years.

Get the full story from your Southern States representatives, or write for Bulletin 59PF.

RE-FUSING IN THE FIELD IS QUICK WITH SOUTHERN STATES FUSE KITS

Economical fuse kits, with all of the components necessary for re-fusing in the field, are available for all Southern States Power Fuses. Four speed ratios—clearly marked, compact packages.

PIONEERS IN POWER FUSES SINCE 1924

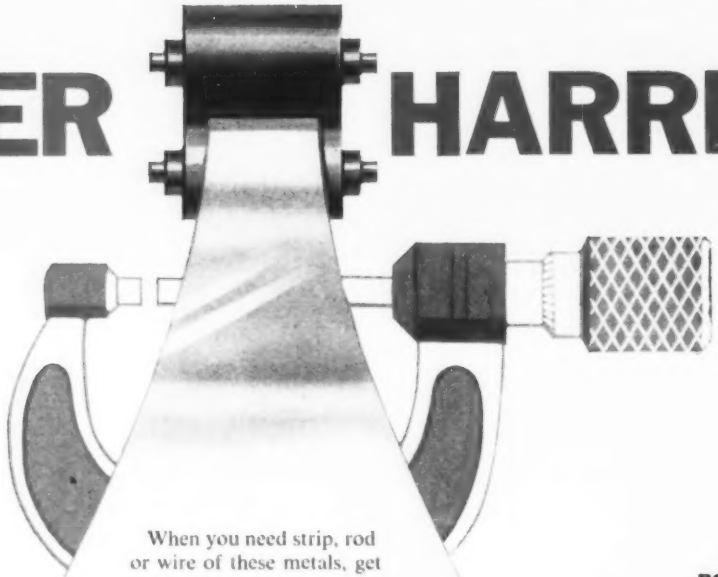
SOUTHERN STATES EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

ROLLED or DRAWN ALLOYS NICKEL MONEL INCONEL

for the widest range of sizes specify

DRIVER HARRIS



When you need strip, rod or wire of these metals, get exactly what you want... from DRIVER-HARRIS, the leading specialist in high-nickel alloys. For nowhere will you find the technical excellence, productive skills and quality controls to match D-H for strip (widths to 8", thickness down to .0005"), rods in various shapes up to ½", wire down to .0005" dia.

Specify "rolled and drawn by Driver-Harris" when you order Monel† *nickel-copper alloys,* Inconel† *nickel-chromium alloys,* Incoloy† *nickel-iron-chromium alloys,* Nickel and Electronic Nickels. They are produced with the same care and quality you expect—and get—with all 132 Driver-Harris alloys.

FREE BOOKLET

Write for your copy of Catalog N-59 containing complete schedule of sizes and prices.

†T. M. REG. U.S. PAT. OFF. ††T. M. THE INTERNATIONAL NICKEL COMPANY, INC. PRODUCTS OF HUNTINGTON ALLOY PRODUCTS DIVISION.

DRIVER-HARRIS* COMPANY

HARRISON, NEW JERSEY • BRANCHES: Chicago, Detroit, Cleveland, Louisville

Distributor: ANGUS-CAMPBELL, INC., Los Angeles, San Francisco • In Canada: The B. GREENING WIRE COMPANY, Ltd., Hamilton, Ontario

MAKERS OF THE MOST COMPLETE LINE OF ALLOYS FOR THE ELECTRICAL, ELECTRONIC, AND HEAT-TREATING INDUSTRIES

SPECIAL PURPOSE ALLOYS SINCE 1890 — D/H — TRADE MARK REG. U.S. PAT. OFF.

For phone number of closest representative see advertising index in back of book.

Republic ELECTRUNITE *E.M.T. was originally installed in concrete during construction of the United States Customs and Court House, St. Louis, Missouri, twenty-five years ago.*

It was necessary to make cuts like this for duct work in the air conditioning and remodeling program. Notice the new-like appearance of the ELECTRUNITE *E.M.T.*

THE BEST COSTS LESS INSTALLED

...in service Twenty-Five years in concrete

Republic ELECTRUNITE E.M.T.

ready for greater load-building today...tomorrow

Republic ELECTRUNITE® E.M.T., 275,000 feet of it, was originally installed during construction of the United States Customs and Court House, St. Louis, Missouri, twenty-five years ago.

Recently, in remodeling for air conditioning, it was necessary to cut through concrete floor, exposing the ELECTRUNITE installed so many years ago. Additional load-building was included in the remodeling program.

Because ELECTRUNITE was originally installed, the remodeling job was easier and faster. Connections were tight. No evidence of corrosion. No delays held up the air conditioning contractor. Additional load-building equipment was added with no trouble.

Here again, time proved... *the best costs less installed.* To learn more about the advantages of Republic's ELECTRUNITE E.M.T., call your electrical distributor. Or use coupon below and write direct.

REPUBLIC STEEL
STEEL AND TUBES DIVISION

REPUBLIC STEEL

Cleveland 8, Ohio

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION
DEPT. C-7844-R
227 EAST 131st STREET, CLEVELAND 8, OHIO

I would like to learn more about the features and installation advantages of Republic ELECTRUNITE E.M.T.

Name _____ Title _____

Company _____

Address _____

City _____ Zone ____ State _____

For phone number of closest representative see advertising index in back of book.

PERFOR

Number 1 reason why the best bargains

IN FLUORESCENT LAMPS, buying on price alone is no bargain at all. (Because the price of the lamps averages only 10% of the operating costs of light.) The other 90% goes for electricity and maintenance. Conclusion? The *best* lamp bargain works your customers' lighting dollar the hardest, gives the most *light* for their money.

How do G-E Fluorescents stack up? Take the popular 4-foot, 40-watt. The new General Electric PREMIUM 3 Lamp, announced in 1959, delivers more light per watt than any previous 4-foot fluorescents. As for maintenance—out of every 1,000 G-E 40-watt fluorescents you sell today, on the average 999 have no defect which can keep them from working—and 990 will still be burning late in 1961! Practically maintenance-free performance like this makes G-E 40-watt, slimline, high output and the exclusive Power Groove Lamps your customers' best bargains in fluorescent light.

IN MERCURY LAMPS, you have the source which can give customers the lowest cost of light of any type of lamp commercially available. Lower than filament—often lower, even, than fluorescent. *And General Electric Mercury Lamps, at any given time in their life, will outperform any other brand the same age . . .* and are built to last as long or longer!

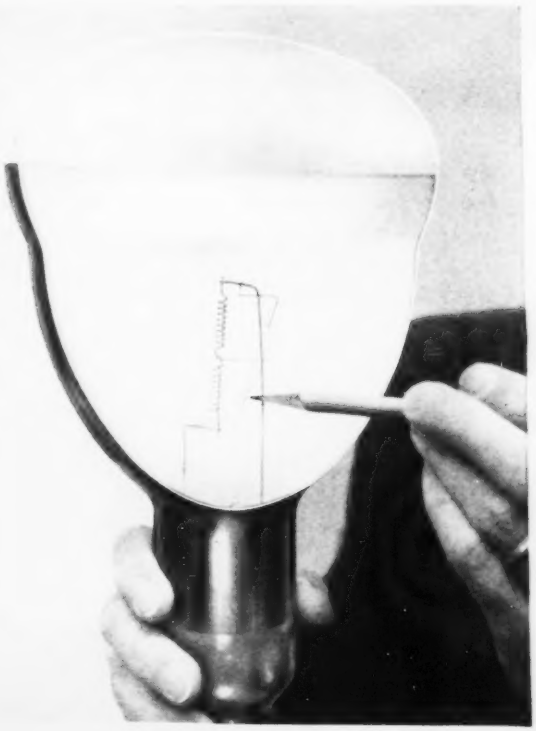
How? In many ways. To name a few—General Electric's dramatic new Bonus Line electrodes, better arc-tube design, and fewer parts to intercept light. And a new 1959 line of six G-E Bonus Line 400-watt Mercury Lamps are the *biggest* bargain in mercury light.

IN FILAMENT LAMPS there are some important differences between brands—some of which are detectable even *before* the lamp goes in a socket. Like the new 1959 smaller, brighter, 100-watt lamp bulb that's small as a 60-watter but delivers more initial light than two 60's. Or the new 1959 G-E Quartzline lamps that are pencil-thin but pack up to 1500 watts.

Or like the new 1959 RB-52 Bonus Line 1000-watt reflector lamp shown at right. Special bulge shape distributes heat, so a less-costly, regular glass is used—with savings passed on to your customers. And look! It uses General Electric's stand-up filament that delivers more light than ordinary "draped" type, has more expensive *silver* reflector instead of aluminum. It gives 20-30% extra light on the work plane. Big things are happening in G-E Filament lamps—all pointing to a bigger bargain in filament light for your G-E Lamp customers.

MANCE

in light are General Electric Lamps



IF YOU RECOMMEND REPLACEMENT LAMPS, then lamp selection is relatively easy. For new installations, however, the job is not often that simple. For this reason General Electric's corps of engineers, technicians and specialists are as near as your phone—to help you help your customers pick the right General Electric Lamp that'll give them the best bargain in light. They'll even aid in recommending the lamp type, size and "color" best for each customer's individual lighting conditions.

FREE FROM G.E. Right now... today you can get a startling new 20-page picture paper packed with factual information on lamps and lighting that can help your customers save big money. For your free copy just send your name and address to General Electric Co., Large Lamp Dept. C-931, Nela Park, Cleveland 12, Ohio. Be sure to ask for "FACTS OF LIGHT". See your G-E Large Lamp Representative for larger quantities.

Progress Is Our Most Important Product

GENERAL ELECTRIC

For phone number of closest representative see advertising index in back of book.

KPF switches

Trouble-free Simplicity

of design, of operation

INSTALL KPF switches more quickly on hot or dead lines, at less cost. Just bore holes in crossarms, mount phase units, connect conductors. No precision requirements, no heavy extra mounting structures, no temperamental complex mechanism to bind, freeze, malfunction or need lubrication.

Rugged, lightweight KPF switches have proved their dependability and economy in half a century of major utility service. Make a test installation on your system—this month.

Fully closed.
Bell crank on crossarm, operated by control rod, will rotate switch blade arm clockwise away from stationary arm holding switch contact clip.

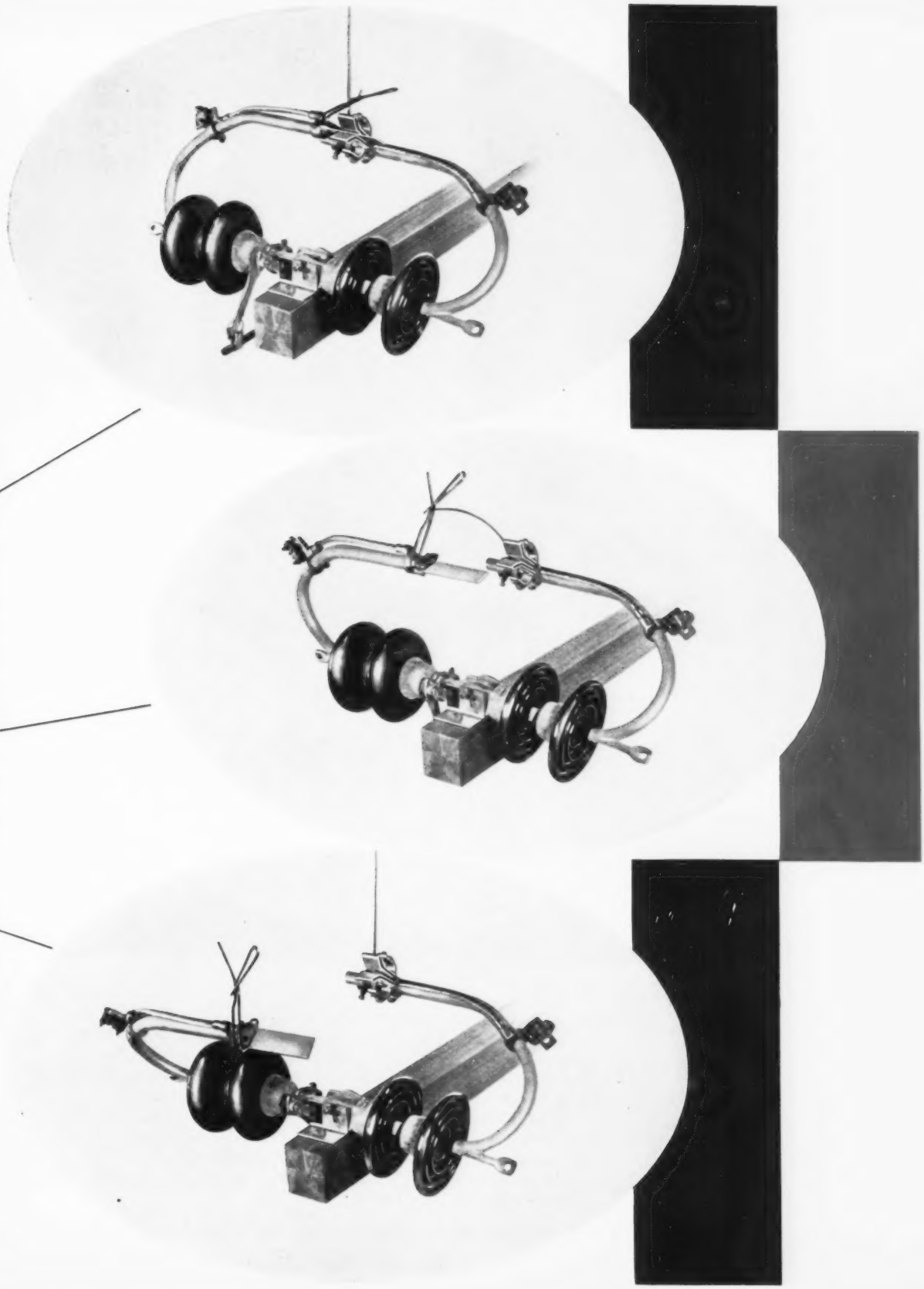
Switch blade arm partially rotated.
Switch blade has separated from clip. Quick-break whisker carries current, prevents arcing.

Switch fully open.
Quick-break has snapped free instantly, preventing arcing. KPF switches operate smoothly despite icing, crossarm warpage; never need lubrication.

KPF
AIR BREAK SWITCHES
Standard for half a century

KPF ELECTRIC COMPANY
P. O. Box 1257W • Stockton, California
HOward 4-8381

For phone number of closest representative see advertising index in back of book.



Are tired eyes costing your office?

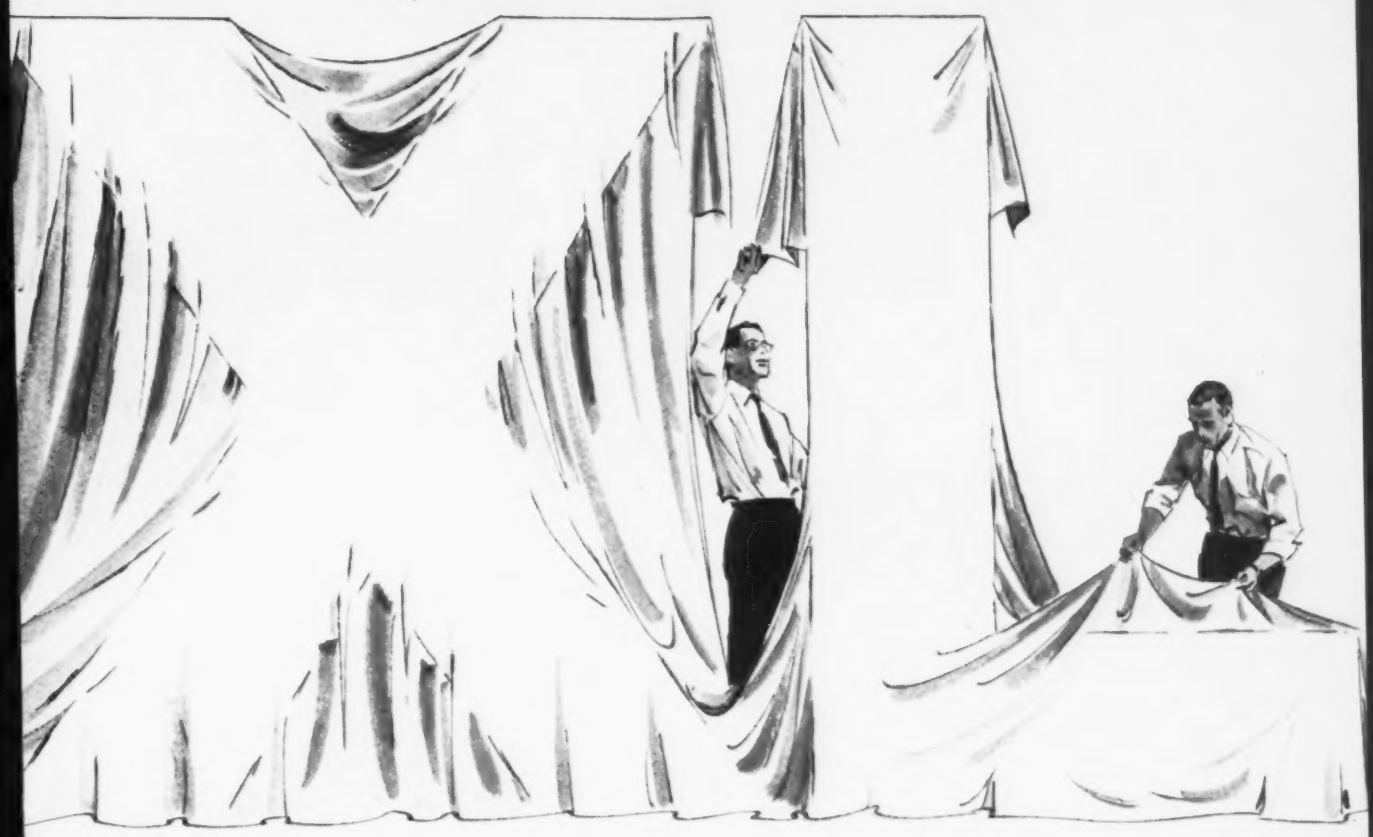
Tired eyes are often the cause of slow and sloppy work. Is your office guilty of gloom-and-glare, shadows and "hot spots"? Efficient lighting should be balanced . . . soft and even everywhere. When it is, eyes see faster (and their owners work better and more easily). Morale goes up — mistakes, down.

A P. G. and E. Lighting Engineer will show you various ways to improve your office lighting without charge or obligation. Or, for additional lighting facts, write Northern California Electrical Bureau, 1355 Market Street, San Francisco 3, for "Fact Book on Certified Lighting for Offices." It's free.

NORTHERN CALIFORNIA ELECTRICAL BUREAU

this message sponsored by **P·G and E·**

Pacific Gas and Electric Company



WHAT'S THE BIG MYSTERY at the N. E. C. A. Exposition ?

Come see! *Preview a great new electrical system that will steal the spotlight for months to come . . . steal the show for sure. Field Sales Engineers from the BullDog Division and from I-T-E Circuit Breaker Company will be on hand to welcome you.*

VISIT BOOTHS

216-217-218-219-220
for the unveiling.

NOVEMBER 9-11

Exhibition Hall
Hotel Fontainbleau
Miami Beach, Florida

BULLDOG ELECTRIC PRODUCTS DIVISION
I-T-E CIRCUIT BREAKER COMPANY
BOX 177 • DETROIT 32, MICHIGAN

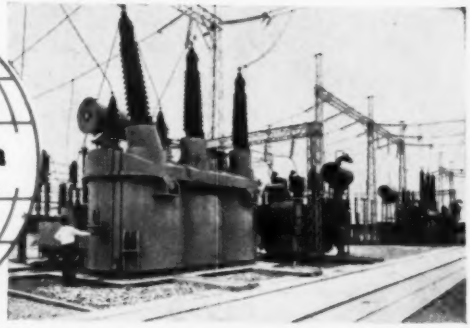
In Canada: 80 Clayton Rd., Toronto 15, Ont. Export Division: 13 East 40th St., New York 16, N.Y.

I-T-E CIRCUIT BREAKER COMPANY
1900 Hamilton, Philadelphia 31, Pa.

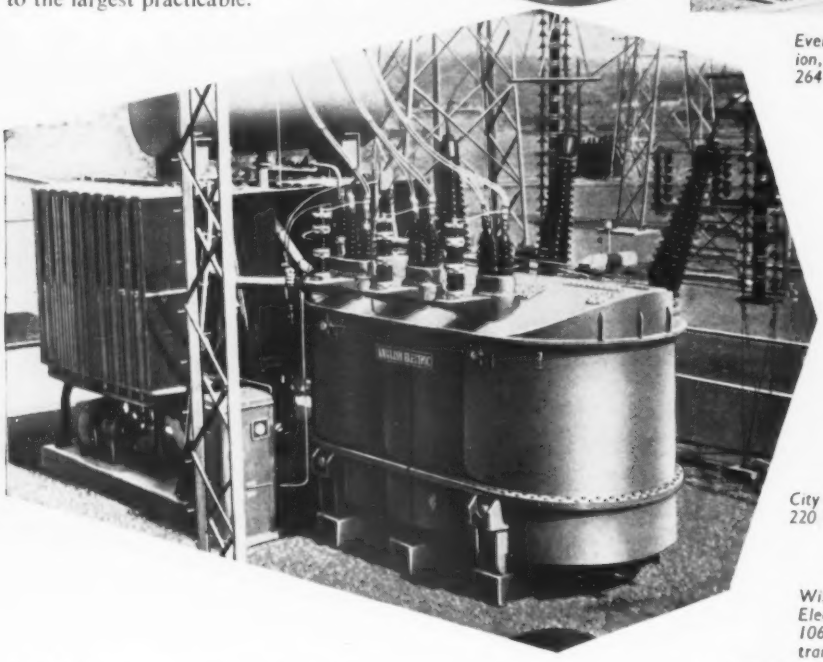
Power Transformers

'ENGLISH ELECTRIC' transformers, in service under varied climatic conditions throughout the world, are built to individual requirements. They can be supplied for voltages up to the highest envisaged and for outputs up to the largest practicable.

in South Africa



Everest Substation, Electricity Supply Commission, South Africa—two of four 150 MVA, 264/132 kV, 3-phase, 50 cycle, auto transformers



in the U.S.A.

City of Seattle, Washington—two 125 MVA, 220/26 kV 3-phase, 60 cycle transformers

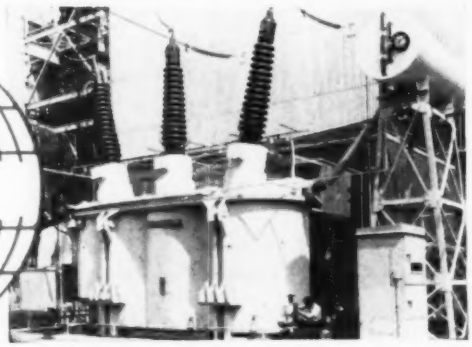
Willington 'A' Power Station, of the Central Electricity Generating Board, one of two 106 MVA, 295 kV, 3-phase, 50 cycle generator transformers

Two of the largest transformers rated at 345 MVA, 22·5/161 kV, 3-phase, 60 cycles, are in service at the T.V.A. Gallatin Power Station, Tennessee.

Contracts have been completed and others are in hand for many other major American power projects.

'ENGLISH ELECTRIC' products cover all aspects of the generation, transmission and utilisation of electric power.

in England



'ENGLISH ELECTRIC'

Agents: ENGLISH ELECTRIC EXPORT & TRADING CO. LTD., 750 THIRD AVENUE, NEW YORK 17, N.Y. Tel: MURRAY HILL 7-0303

Sub Agents:—

James I. Metcalf & Co. Inc., 701 United Pacific Building, Seattle 4, Washington. Branch offices in San Francisco, Los Angeles, Portland, Phoenix, for Alaska, Arizona, California, Idaho, Montana, Nebraska, Nevada, Oregon, Utah, Washington and Wyoming.

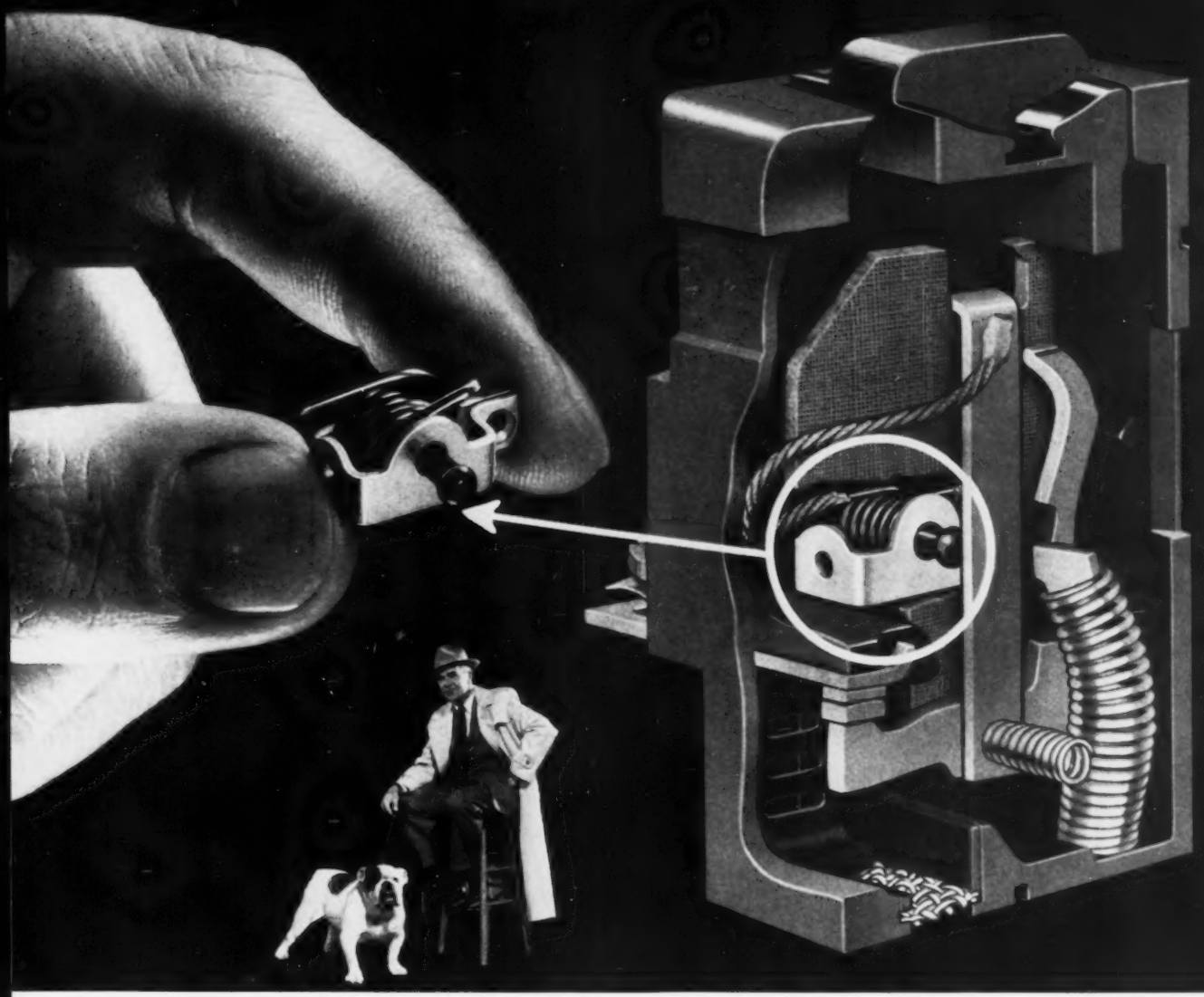
Osgood and Associates Inc., 988 Spring St., N.W., P.O. Box 7383, Station C, Atlanta 9, Ga., for Alabama, Florida, Georgia, Kentucky, South Carolina and Tennessee.

Electron Equipment Co. Inc., 1050 Constance St., New Orleans, 13, La., for Louisiana and Mississippi.

Peabody Bros., 2903 St. Louis St. at Oakland, Dallas, 26 Texas. Branch offices in Houston and Tulsa, for Arkansas, New Mexico, Oklahoma and Texas.

SERVICE FACILITIES ARE AVAILABLE THROUGH THREE LARGE CANADIAN PLANTS

OC/US/6



NO TROUBLE CALLS WITH PUSHMATIC

coil protection is standard in every breaker

Protect branch circuits against high overloads and "flash-shorts" with Pushmatic® magnetic coil action! BullDog, the first to offer this protection in 15-amp and 20-amp ratings seven years ago, builds this safeguard *into every Pushmatic breaker*. The solenoid (coil)—coupled with the thermal element—provides *double* circuit safety. Makes trouble calls a thing of the past.

As you can see in the above picture the Pushmatic uses a *multi-turn coil*. High overloads or "flash-shorts" instantly set up a magnetic field in the coil—causing the metal plunger to trip the latch and break the circuit. BullDog Pushmatics provide not only maximum branch circuit protection, but protect lamp and appliance cords, too!

Small overloads are taken care of by the thermal-bimetal latch. An overloaded circuit heats the bimetal causing the latch to curve and release. A built-in time delay prevents nuisance tripping in case of harmless overloads.

Play it safe. Protect branch circuits with Pushmatic coil action! Each and every Pushmatic is rigidly tested to assure precision operation. You'll find Pushmatic double protection pays off! Multi-turn coils are standard in all Pushmatics—15 amperes through 50 amperes.

BULLDOG ELECTRIC PRODUCTS DIVISION
I-T-E CIRCUIT BREAKER COMPANY
BOX 177 • DETROIT 32, MICHIGAN

® In Canada: 80 Clayson Rd., Toronto 15, Ont. Export Division: 13 East 40th St., New York 16, N.Y.

Consult the following Pacific Coast representatives:

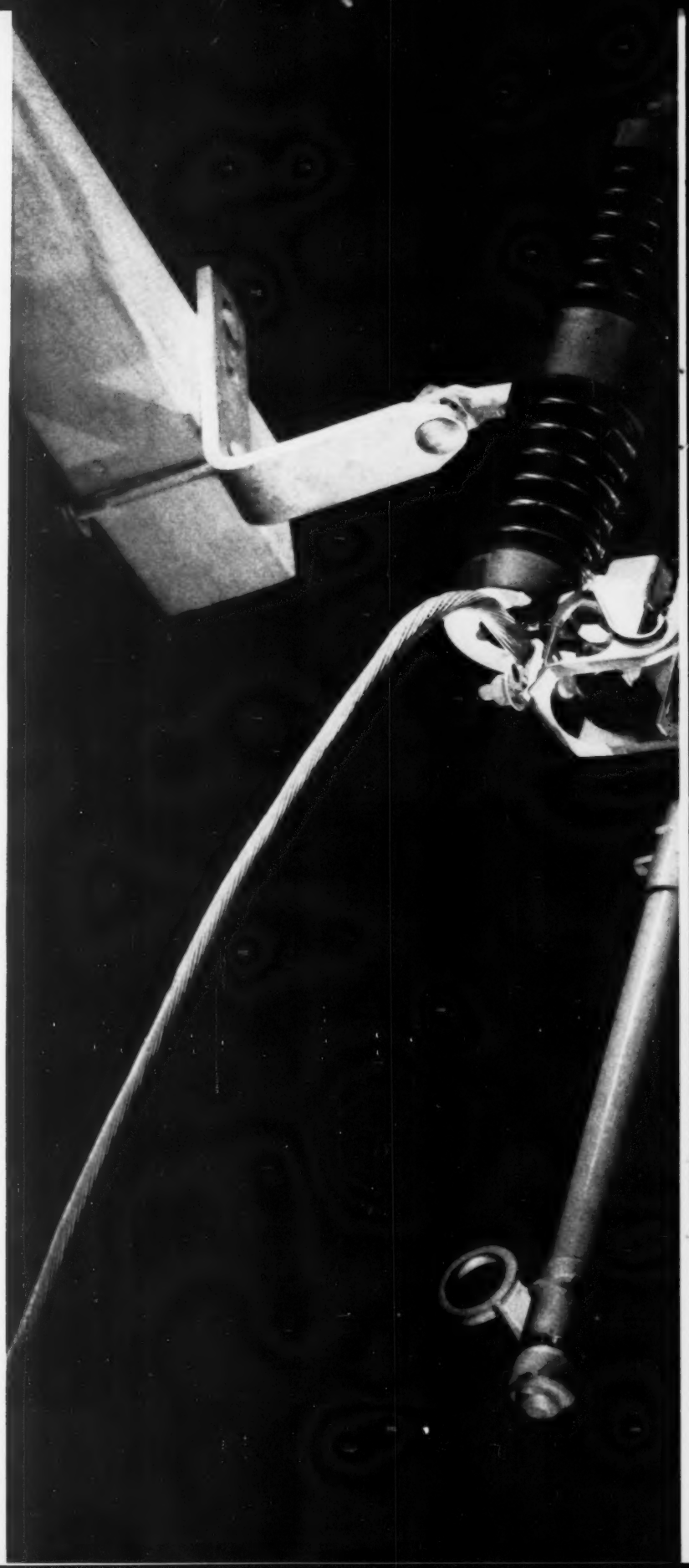
Coast Electric & Manufacturing Co.
1733 N. E. Seventh Ave., P. O. Box 7712
Portland 12, Oregon

Young Electric & Mfg. Co.
2134 Curtis St.
Denver 2, Colorado

Safety Switchboard Company
910-89th Avenue
Oakland 21, California

BullDog Elec. Prod. Co. of Los Angeles
2885 E. Washington Blvd.
Los Angeles 23, California

ALMOST HANGS ITSELF



S & C Open Cutouts take the "hit and miss" out of fuse tube handling

It's a cinch to hang the fuse tube in the Type XS open cutout. No fumbling, no missing, no dropping. Think how much easier and safer it makes the lineman's job, especially at night or during adverse weather. The operator's eye view at left shows why linemen like this cutout. There's nothing intricate about the hinge and how to approach it. Notice the wide and deep trunnion pockets in the ears of the hinge. The trunnions on the fuse tube drop in readily, without precise "steering."

Yet once the fuse tube is hung in the hinge it is positively kept from jamming or missing as it is swung closed. Multiple steering surfaces at the hinge and trunnion along with wide-angle upper contact guides give positive control. The tube can be slammed closed, blind.

Easy fuse tube installation is just one of many big advantages of S&C XS Open Cutouts. Here are more: 1) exhaust always goes down and away from operator and conductors because of single venting; 2) arc energy and exhaust violence are minimized by an "arc-shortening" device; 3) you get versatile, economical load switching with Loadbuster® (the portable loadbreak tool).

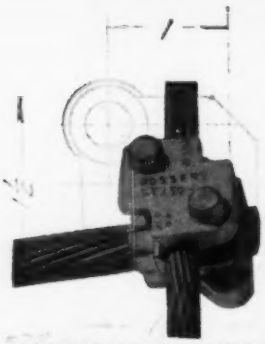
To get an idea of how the XS open cutout can give you system-wide protection and switching, please write S&C Electric Company, 4425 Ravenswood Avenue, Chicago 40, Illinois . . . and ask for Bulletin No. 511 "S&C Open Cutouts—Type XS."

S&C ELECTRIC COMPANY

S&C

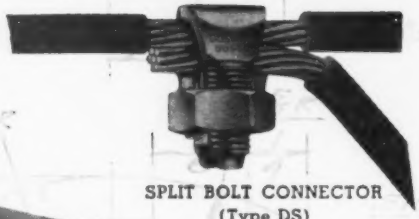
DOSSERT DESIGNED

with YOU in mind!

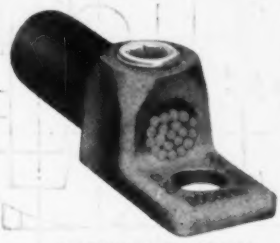


TWO POSITION VARIABLE TAP
(Type GTX)
For cross, parallel and tee tap connections.

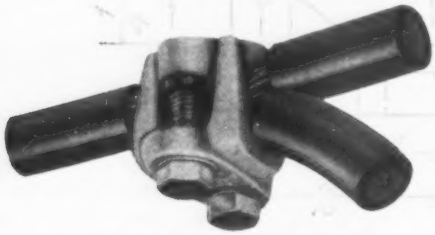
LIGHT DUTY VARIABLE LUG
(Type G)
For economical, all-purpose cable connections.



SPLIT BOLT CONNECTOR
(Type DS)
For taps, dead-ends, entrances, motor leads, junction boxes, etc.



VARIABLE TERMINAL
(Type D)
Connects a wide range of copper conductors to flat bar.



TWO BOLT SERVICE CONNECTOR
(Type DSU)
For all service cable connections.
Best for larger sizes.

HEAVY DUTY VARIABLE LUG
(Type HL)
Takes various conductor sizes.
Quickly installed.

For YOU, the contractor...
For YOU, the wholesaler...

The products shown here are in constant demand by contractors and are fast moving stock items. All items accept a wide range of cables, thereby, minimizing the number of stock sizes. They are packaged in convenient quantities for ease of handling and are attractively labeled for quick identification.

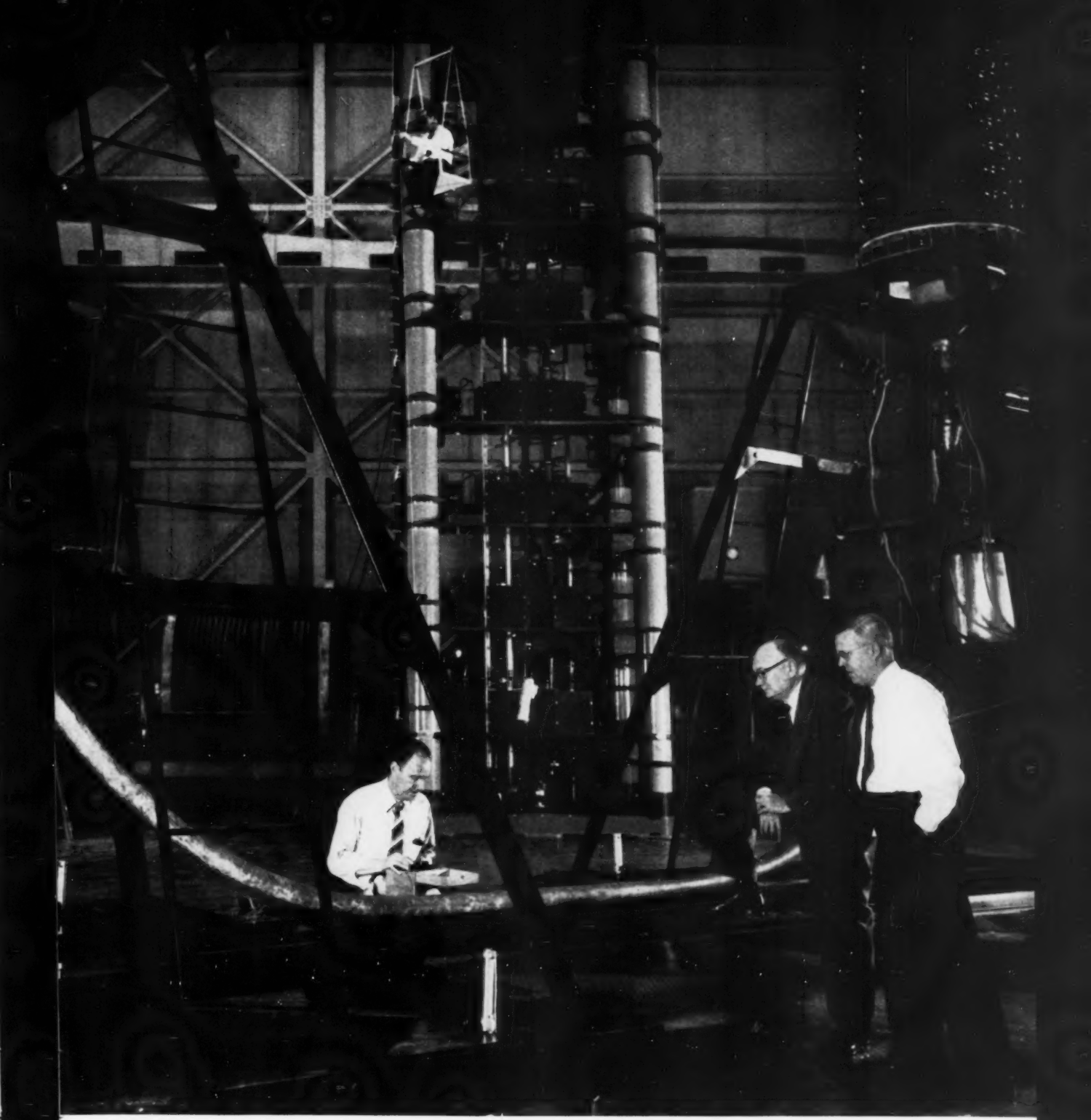
"For Pocket Catalog, write to:
Northeast Electrical Sales
15-21 Webster Ave.,
Cambridge, Mass."

50 YEARS OF TECHNICAL KNOW-HOW

DOSSERT MFG. CORP.
249 Huron Street, Brooklyn, New York
Representatives in principal cities.

Distributed outside the U.S.A. and Canada by:
INTERNATIONAL GENERAL ELECTRIC COMPANY
Construction Materials and Lighting Sales
150 East 42nd Street,
New York 17, N.Y., U.S.A.

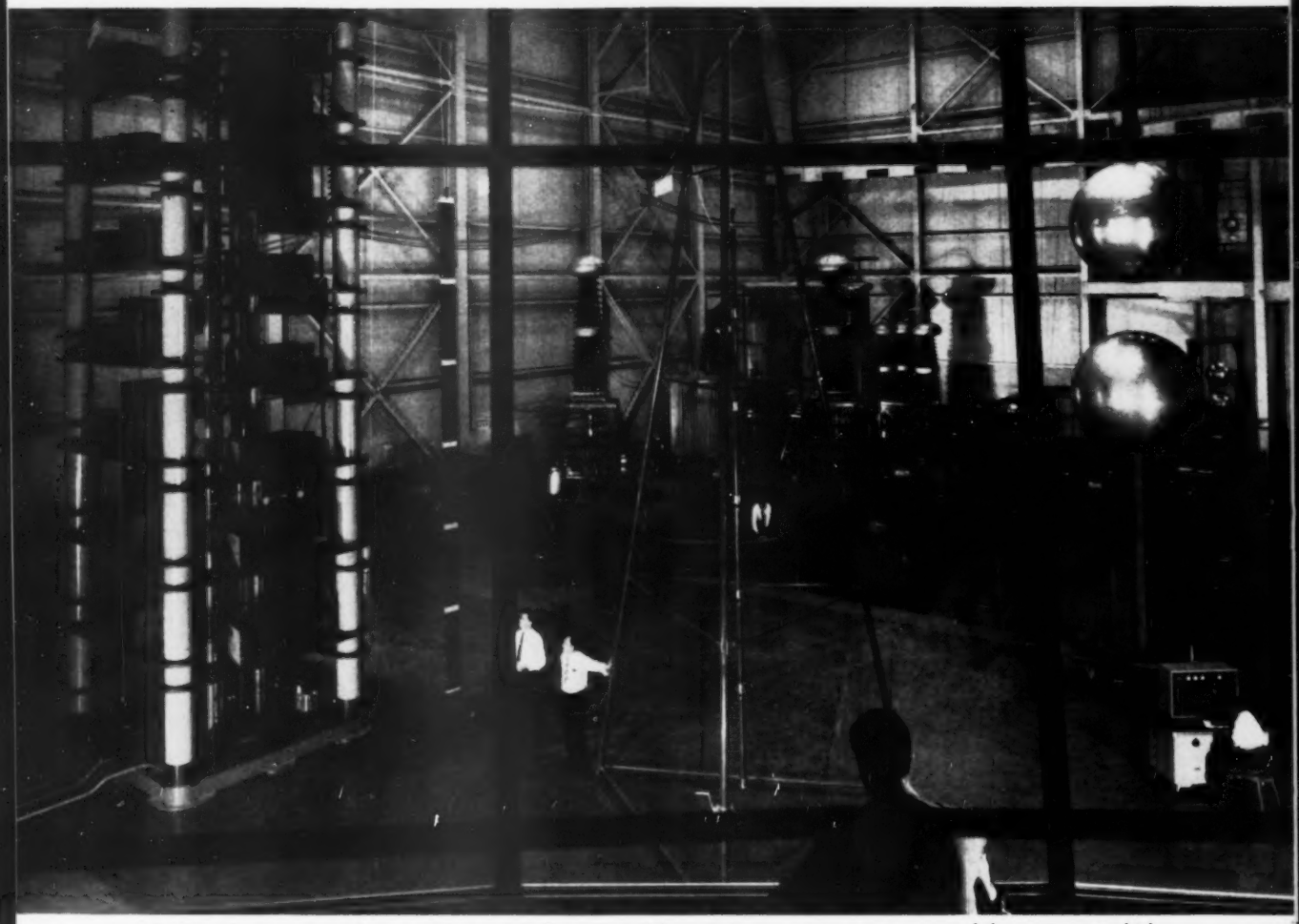
For phone number of closest representative see advertising index in back of book.



NOW, THE NATION'S MOST MODERN EXTRA-HIGH-VOLTAGE CABLE AND ACCESSORIES DEVELOPMENT LABORATORY IS BEHIND THE MAN FROM ANACONDA

Anaconda's new Extra-High-Voltage Laboratory—

AN "IMPROVING" GROUND FOR TODAY'S HIGH-VOLTAGE CABLE



Looking from the control room at Anaconda's Extra-High-Voltage Laboratory, you can see some of the equipment which helps make this the most modern laboratory of its type in the nation.

Lightning *does* strike twice in the same place.

Lightning—3 million volts of it—is a regular occurrence on the Impulse Generator in Anaconda's new Extra-High-Voltage Laboratory at Hastings-on-Hudson, New York. It generates enough voltage to break down any known cable. More than that, this generator is a symbol, an example of the vast extra-high-voltage (EHV) facilities which enable Anaconda engineers to duplicate *actual in-service* conditions—to find out how today's cable can be improved to deliver more power more efficiently.

Most powerful "improving" facility is the cyclic load testing. Cable samples aren't short lengths employed in ordinary lab work—aren't heated by trick means and don't have high resistance conductors. They're full-sized commercial cables, heated by actual load current in the conductor and energized continuously with voltages 150% of rated. The equipment tests cable up to ratings of 5400 mva (5 *billion* watts —more than New York City uses!).

A PROVING GROUND FOR TOMORROW'S EHV CABLE AND ACCESSORIES

Here you see an essential step in the development of an Anaconda accessory—full-scale and exacting electrical testing.

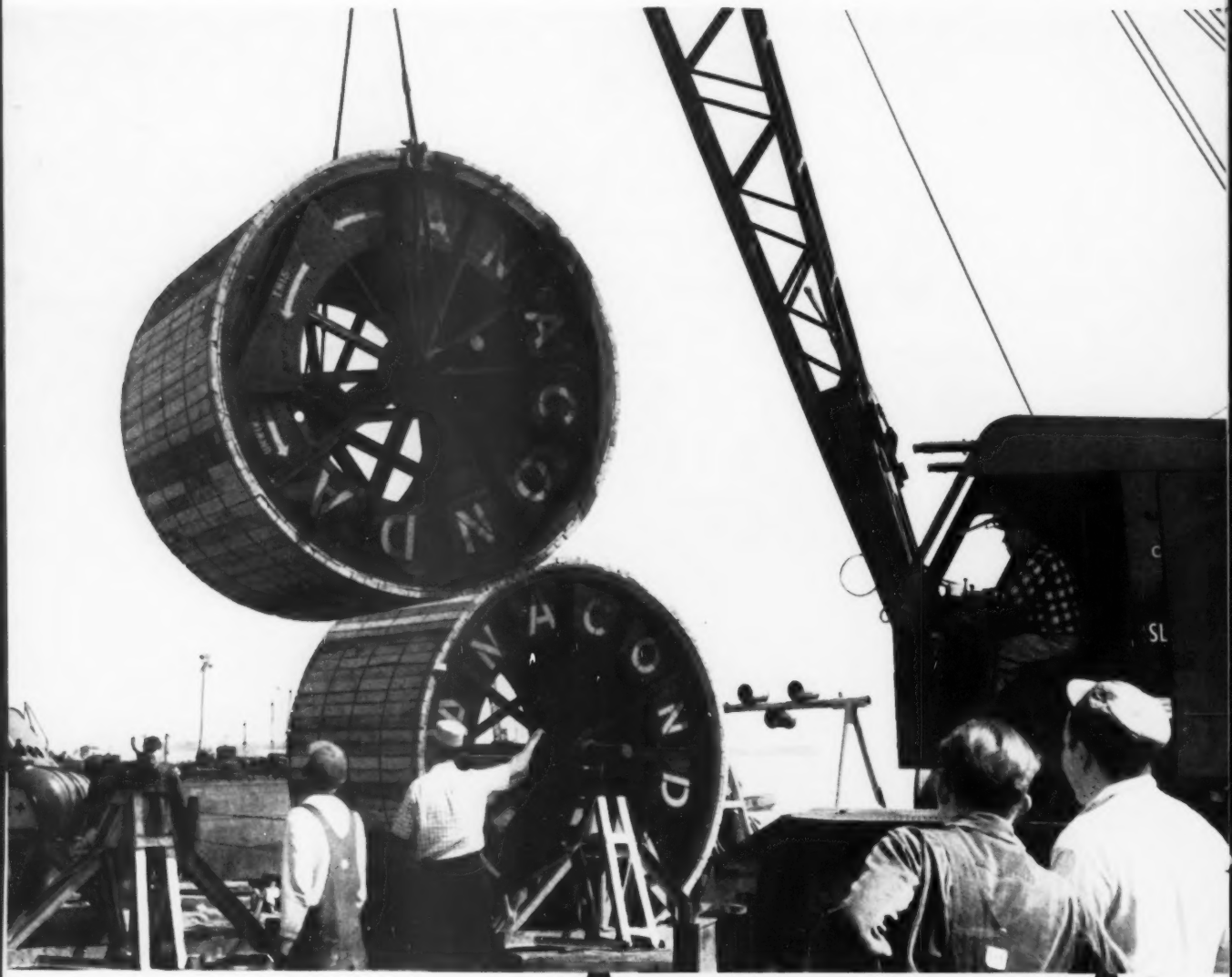
When it becomes necessary to go underground —due to lack of urban space—the solution is high-voltage cable, 138 kv and 230 kv today, 345 kv—even higher tomorrow. Right now, Anaconda engineers are developing the cables and accessories for tomorrow's anticipated demands and higher voltage requirements.

As every engineer knows, high-voltage cables must be jointed with extreme care—in extra-high-voltage cable installations, it is mandatory that jointing and terminating be so designed as to be just as reliable as the cable itself. That is why Anaconda has been designing and building accessory equipment—for over thirty years.

59255

Turn the page to see Anaconda Cable going into another new installation.

ANOTHER UTILITY LOOKS TO TOMORROW BY INSTALLING ANACONDA HIGH-VOLTAGE CABLE TODAY

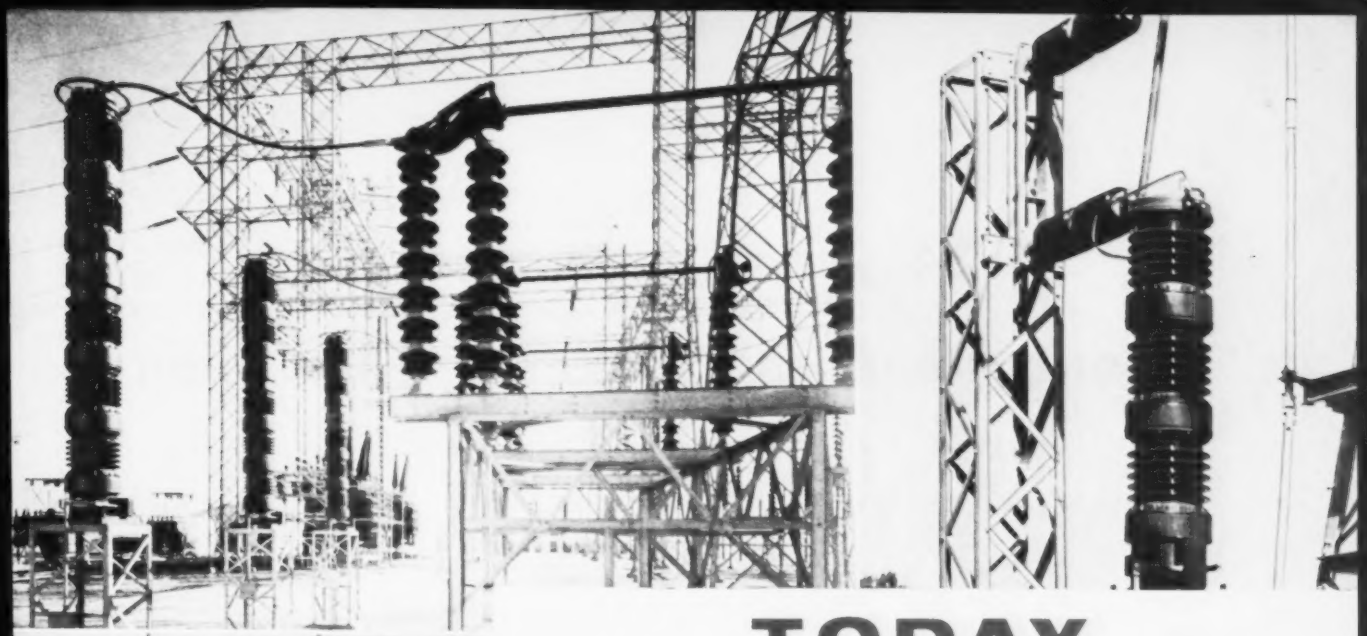


Anaconda 138 kv cable being delivered for installation by Consolidated Edison of New York—another step in the planned expansion of this utility to keep ahead of electrical demands in the growing dynamic area they serve.

ANACONDA®

WIRE AND CABLE COMPANY

FASTEST WESTERN SERVICE—At Orange, California, Anaconda's expanded, modernized mill fabricates and stocks copper and aluminum wire and cable for *every type of application.* Anaconda assures the fastest possible service on all West Coast needs. See Anaconda Sales Offices: Los Angeles, San Francisco, Seattle, Denver.



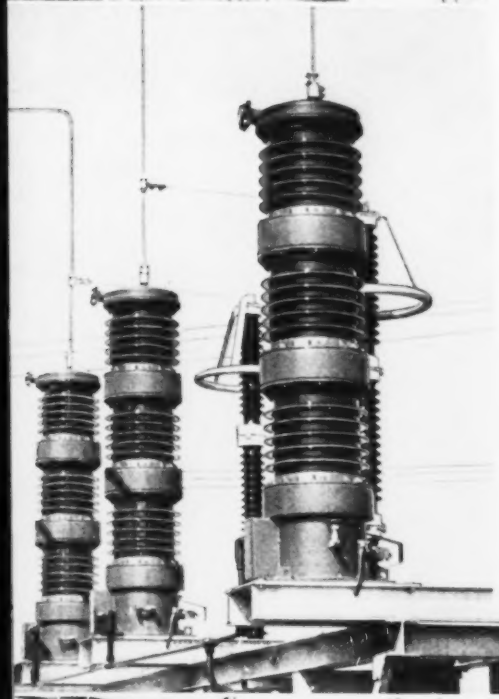
TODAY NEARLY 1,000

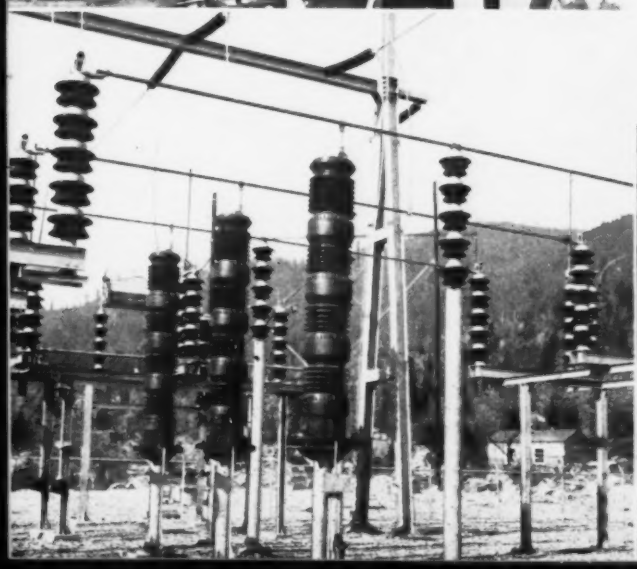
General Electric cascade transformers are in service . . . without a single electrical failure being reported. This is transformer reliability.

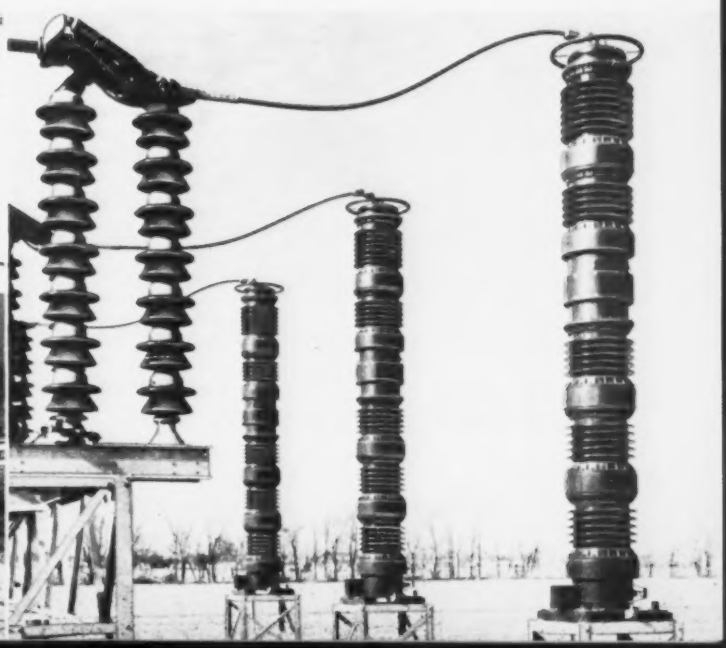
General Electric Company, Section 629-3, Schenectady 5, N. Y.

Progress Is Our Most Important Product

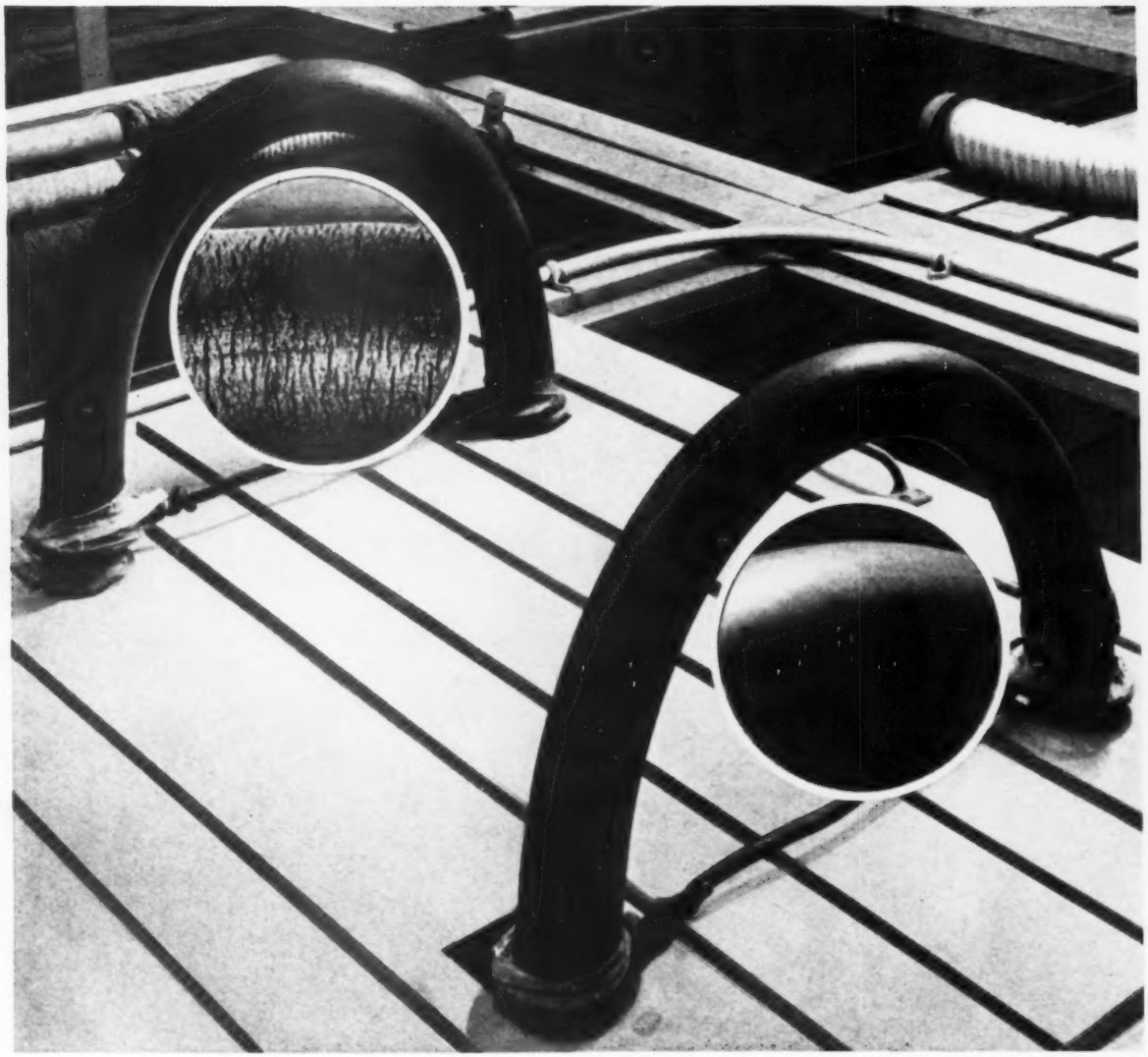
GENERAL ELECTRIC







24 years under the sun: only neoprene jacketing gives you this time-proven reliability



24-year test. January, 1935, cable jacketed with neoprene and natural rubber were placed in this outdoor proving ground. The cable samples were bent to put stress on the jackets, increasing the jacket's vulnerability to ozone cracking.

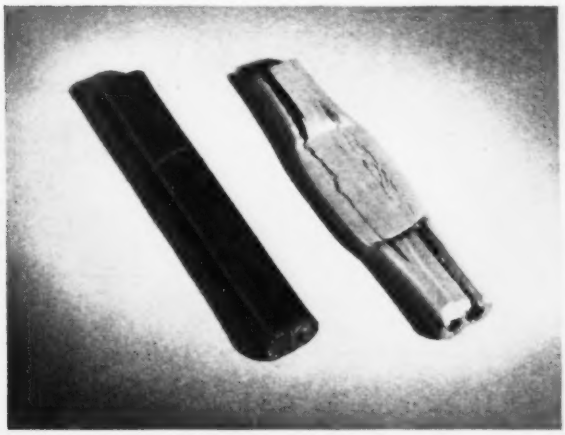
Today, the natural rubber has almost no physical strength. But the important point is this: after 24 years in the sun and weather, the neoprene jacket is still lively and tough . . . no cracks . . . no visible deterioration.

Neoprene's performance as a jacketing for wire and cable is backed up by over 20 years of actual service . . . service that has gained neoprene a reputation for reliability and long-term economy.

Neoprene's reputation has been earned by a combination of properties that make it unequaled by any other jacketing material. Neoprene resists:

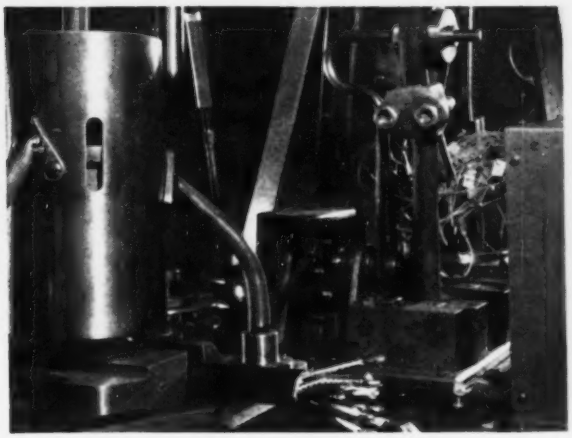
Weather, sunlight and aging
Wide temperature variations
Flame, ozone, corona
Oil and grease
Many organic and inorganic chemicals
Soil acids and galvanic action
Impact, gouging, cutting

Neoprene's time-proven dependability is your guarantee that above or below ground, you can be confident of long service life, long-term economy when you specify neoprene.

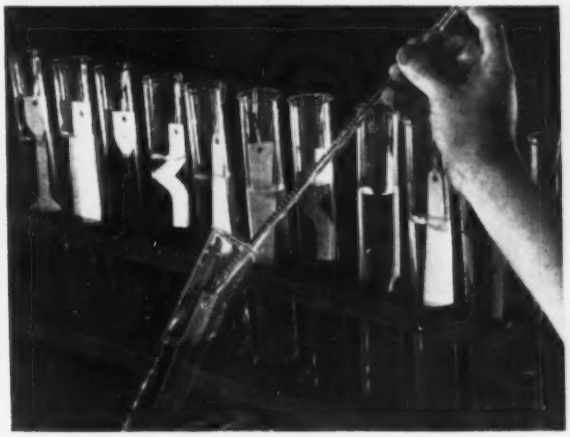


No plastic flow with neoprene. At high temperatures some jacketing materials soften and flow, making cable vulnerable to abrasion and impact damage. Neoprene is vulcanized, does not revert and flow at high temperatures. (Sample compressed 8 hrs. @ 75 psi @ 302° F.)

Low temperature flexibility with neoprene. At low temperatures, neoprene remains flexible and resilient. This property helps insure the cable jacketing material against damage from impact or twisting at subzero temperatures.



Outstanding impact resistance with neoprene. It protects cable from damage by impact, cutting and gouging. This impact tester wallops the cable jacket. No other jacketing material takes this test as well as resilient neoprene.



Chemical resistance with neoprene. Its resistance to a wide range of chemicals is valuable in industrial applications. In underground installations neoprene resists soil acids and prevents deterioration from galvanic action.

DU PONT
REG. U. S. PAT. OFF.

SYNTHETIC RUBBER

NEOPRENE
HYPALON®
VITON™
ADIPRENE®

Better Things for Better Living . . . *through Chemistry*

For phone number of closest representative see advertising index in back of book.

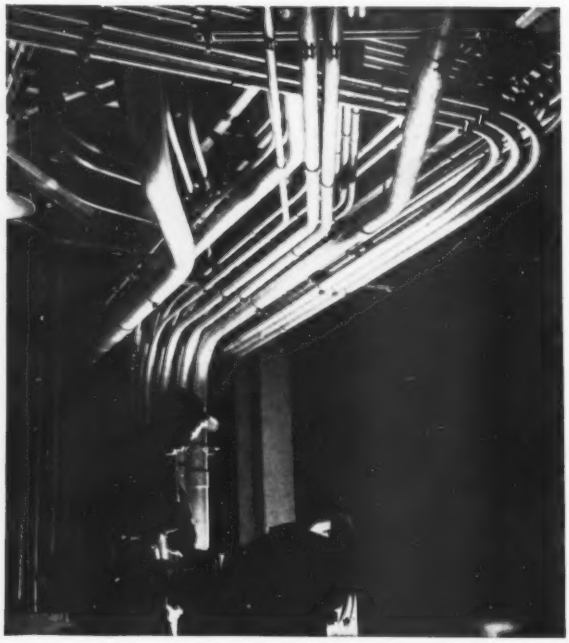
LIGHTWEIGHT KAISER ALUMINUM RIGID CONDUIT reduces handling and installation costs

WEIGHT COMPARISON, ALUMINUM VS. STEEL

U.L. required minimum weight per 100 ft. including couplings, lbs.

Trade Size, Inches	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6
ALUMINUM	27.4	36.4	53.0	69.6	86.2	115.7	182.5	238.9	287.7	340.0	465.4	612.9
STEEL	79.0	105.0	153.0	201.0	249.0	334.0	527.0	690.0	831.0	982.0	1334.0	1771.0

This chart shows 66% reductions in the weight of aluminum conduit as compared to steel conduit. Result: easier handling, reduction in worker fatigue, lower labor costs.



CHECK the chart . . . aluminum conduit weighs only *one-third as much* as steel conduit!

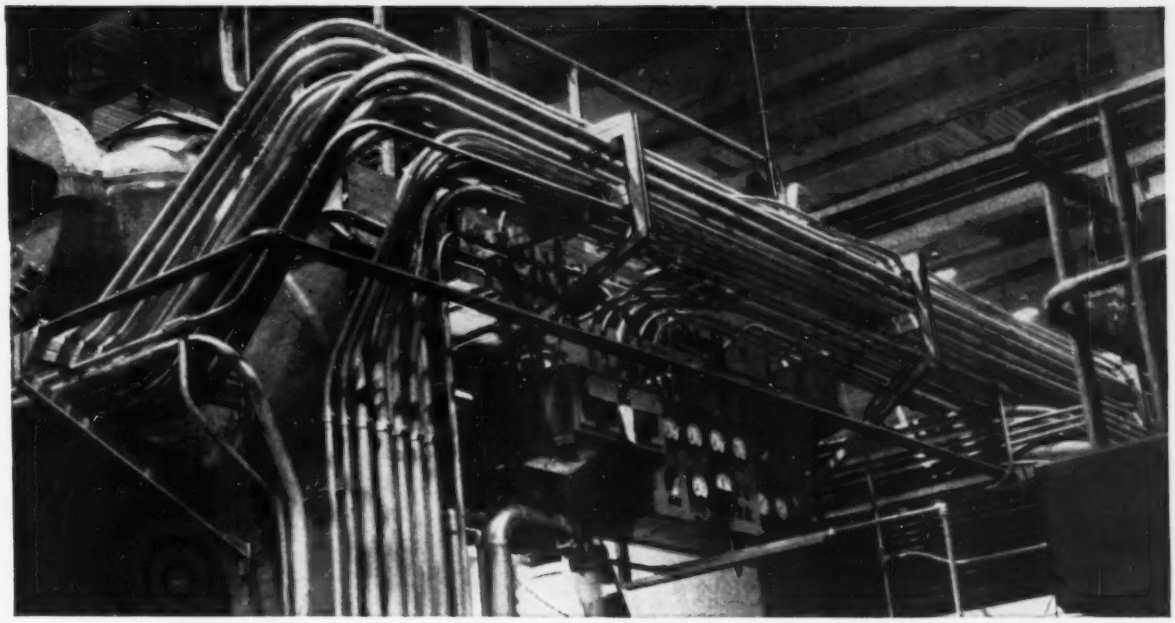
This lighter weight pays off in faster installation with less worker fatigue. Result: lower installation costs . . . with savings up to 50% in some cases!

And here's another cost-saver: lightweight aluminum conduit requires fewer hangers or supports. For large cable-conduit feeders in sizable groups or banks, the number of supports can be greatly reduced. Definite labor savings can be made, especially where supports must be installed in masonry with star drills.

Aluminum conduit's lighter weight pays off in lower handling costs too. For example, standard 10-foot lengths of ¾" steel conduit, usually delivered in groups of five, weigh 53 pounds delivered. Similar aluminum conduit, *delivered in groups of ten*, weighs only 37 pounds.

Corrosion Resistant To Cut Maintenance Costs

The excellent resistance of aluminum to atmospheric



and chemical corrosion has been proved by numerous and extended exposure and laboratory tests, and by countless applications in the process industries.

Aluminum's ability to resist corrosion means that maintenance is virtually eliminated. No painting is needed. Replacement costs are held to an absolute minimum.

And, since aluminum can't rust, cost economies can also be realized in storage. No special storage preparations are necessary.

Nonmagnetic To Reduce Voltage Drop

Because aluminum conduit is nonmagnetic, it is not subject to magnetically-induced energy losses.

This reduction of energy loss permits a longer run of cable without exceeding the voltage drop as specified in the National Electrical Code. In some installations this will permit the use of a smaller size conductor and conduit.

A further advantage is that each conductor in either a single-phase or polyphase system can be enclosed in a separate aluminum conduit, regardless of electrical load. Separate rigid conduits greatly simplify installation of electrical equipment having widely spaced terminals. Terminal overcrowding is eliminated.

Get ALL The Facts Now!

We will be glad to send you an informative 9-page magazine article entitled "Now We Can Specify Aluminum Conduit."

This article contains a complete run-down on the advantages of using aluminum conduit—comparative conduit weights, comparative labor cost charts, installation facts, and much more valuable information.

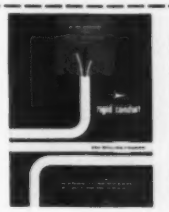
We'll also send our *Aluminum Rigid Conduit* brochure, with installation data, specifications and availabilities for Kaiser Aluminum rigid conduit.

Get *all* the facts about aluminum rigid conduit and how it can save you money. Mail the coupon now!

KAISER ALUMINUM

IF IT CARRIES CURRENT, KA CARRIES IT!

See Aluminum Conduit featured on "Maverick"



Kaiser Aluminum & Chemical Sales, Inc.
Electrical Conductor Division
Dept. CO-129
1924 Broadway, Oakland 12, California

Please send your *Aluminum Rigid Conduit* brochure and aluminum conduit magazine article.

NAME_____

ADDRESS_____

CITY_____ STATE_____

LETTERS TO THE EDITOR

Decimal Missed?

To the Editor:

In the July 1959 issue, p 10, I note that in using seven million gallons of gasoline there would be involved 50 inflight refuelings. Neglecting the original load, this would seem to be approximately 140,000 gal per refueling.

By my slipstick, this would come to about 1,000,000 lb or 500 tons of fuel for each refueling.

Wow! Did one of us miss that elusive decimal point?

G. E. Buck
System Protection & Control Sales
Apparatus Sales Division
General Electric Co.
Schenectady 5, N. Y.

Reader Buck is right but it's not the decimal point! According to UAL, a DC-7 could fly six times around the world on about 250,000 gal of gasoline. Weight: approximately 700 tons.—The Editor.

Floor Grid Questioned

To the Editor:

I read with interest an article in your August issue of ELECTRICAL WEST written by Glenn E. Hutchcroft and Howard P. Gluckman, Los Angeles Department of Water & Power, regarding several installations of low cost, low voltage, radiant floor heat installed by the Department of Water & Power of the city of Los Angeles.

We have had two attempts by a midwestern company to get permission here in the state of Oregon and the city of Portland to install a similar system using 60 v across the grid supplied by a 1-1 ratio two coil transformer for each grid. Each transformer was to supply two grids, as the primary supply was to be 480-v delta and the secondary 120 v with midpoint grounded.

The State Electrical Advisory Board and the city of Portland Electrical Appeal Board, meeting in joint assembly, turned down both appeals because the low-voltage grid did not comply with the minimum requirements of the National Electrical Code and the heating grid was not a listed method of supplying radiant heat electrically.

Our Appeal Boards recommended that the company submit their heating grid system to Underwriters' Testing Laboratories for fact finding report and that rules governing the installation of uninsulated heating grids be developed and submitted to Code Making Panel No. 10 of the NFPA Electrical Section for study, with a request that such rules be adopted for insertion in the National Electrical Code.

The company concerned, on March 30, 1959, did write to the NFPA addressing their letter to Mr. Charles L. Smith (deceased), and the letter was answered on April 8, 1959, by Mr. Merwin Brandon, chairman of the Electrical Section NFPA, in which Mr. Brandon suggested the company do the exact same as our two boards had recommended (submit rules to Code Making Panel No. 10, NFPA Electrical Section).

I have a copy of Mr. Brandon's letter to this company, and in it he expresses a thought that using a bare uninsulated grid of any kind for electrical radiant heat was putting it thin as to the safety factor from the standpoint of shock.

We believe that before such system should be publicized as an acceptable system it should first be acceptable to the National Electrical Code, which the Los Angeles system of heating is not, and to publicize such an unapproved system only makes trouble for all of us who are trying, at least, to follow the minimum standards of the National Electrical Code.

J. F. GRAY
Chief Electrical Inspector
Electrical Division
Portland, Ore.

To the Editor:

Thank you for . . . the copy of a letter of Aug. 17 from Mr. J. F. Gray, chief electrical inspector of the Bureau of Buildings of the city of Portland, Ore.

In his letter Mr. Gray cited two attempts to gain the approval of the State of Oregon and the city of Portland for the installation of a radiant floor heating grid system using 60 v to ground, and 120 v line to line. Mr. Gray's comments are heartily appreciated because they deal with a subject of paramount importance to all, the matter of shock hazard to personnel. However, a difference in fundamental concept is noted, an attempt to compare equipment operating at more than 50 v to ground with equipment operating at less than 50 v to ground. As stated in the article, our floor heating systems operate at a maximum of 24 v to ground, and a maximum of 48 v line to line.

When first considering this type of installation, we carefully reviewed the national, state and city electrical codes. We found restrictions in these for circuits of more than 50 v to ground which would prohibit their use in a bare grid mesh floor heating system, but we found no prohibition as to the use of 24 v to ground in this application.

For purposes of considering shock hazard, we always assume the topping to have no insulating value at all. This is, of course, an impossible condition which would completely short circuit the floor but it is recognized that the topping may become crazed and in time cracked and may even have water on it. In any event, this assumption provides a practical means of injecting some additional factor of safety into the design.

If the maximum of 24 v to ground potential of the Department of Water & Power's floor heating system is not acceptable to the National Code, then it would appear that the National Code is inconsistent in this respect. We contend that it is acceptable and that there is no inconsistency on this point.

There is another matter of shock hazard also to be considered in the design and use of a bare grid mesh system. This is that of difference in potential between adjacent areas of the floor resulting from IR drop. In our design from 240 to 280 lin ft of grid mesh strip is used for one 48-v circuit. Under these conditions the IR drop is approximately 0.2 v per lin ft; because the grid is wire mesh it seems nearly impossible that any damage to the floor would sever all strands of a strip, placing open circuit voltage across a small area of floor. This, of course, is possible with a single conductor system. Care in the arrangement of the strips in the circuit can almost always result in a floor in which the maximum difference in potential in the bare grid between any two points on the floor six feet apart will not exceed 12 or 14 v. *Even without the two-inch concrete topping, a workman should be able to walk on the energized bare grid in his bare feet without experiencing any physical discomfort from electric shock.*

Prior to the first installation we discussed the safety features with state and city inspection agencies and were granted a permit for a test installation. Test data obtained therefrom convinced everyone concerned that shock hazard is negligible. Consequently, we have had no difficulty in obtaining permits and approval for subsequent installations. For these reasons, the freedom from shock hazard has become so commonplace that we did not give it detailed mention in our article in the August edition of ELECTRICAL WEST.

While our system of bare grid mesh floor heating is not specifically covered by the National Electrical Code, we feel that approval of its principles is implied by Section 2545(c).

We believe it is an obligation of all members of our industry to help the code keep up with progress. We also feel that there is definite need for code recognition of floor heating systems of this type and of proper requirements for their installation so as to provide complete safety in their use. Undoubtedly the realization of this need is what prompted your letter and we appreciate the opportunity of making this reply.

The Department of Water & Power has 12 of these floors, which have been in use for periods of time ranging from one to eight years.

We would be glad to supply any data and observations on the installation and use of these floors which would be of assistance in developing the next revision of the code so that these heating systems can be *specifically* recognized.

Glenn E. Hutchcroft
Howard P. Gluckman
Department of Water & Power
Los Angeles, Calif.

Lambasted Eggs

To the Editor:

My comment on the cover picture (August) of ELECTRIC WEST:

This is a hell of a way to fry an egg!

The very sight of a perfectly good egg being given a "brown leather base" on a *hot* griddle gives me indigestion!

Why can't American cooks learn how to fry eggs?

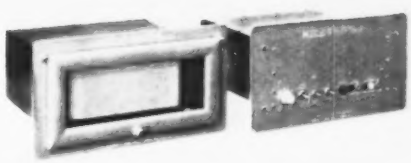
Ralph Phillips
Vice-President
San Diego Gas & Electric Co.

To sharp-eyed gourmet Phillips—an alibi is offered. Frying eggs for artistic photography is a combination that will give editors indigestion, too.—The Editor.

monitor automatically with the new

HAMILTON *Direct Writing* OPERATIONS RECORDER

This compact recorder is ideal for monitoring power company substations or unmanned transformer stations, for example, where an abnormal current or a breaker operation will initiate a recording cycle. The resulting record permits analysis at any later time of the sequence of operation of protective equipment. Traces for the 6 off-on channels or the single analog (digitized) channel are produced upon electrosensitive paper by fixed styli for instant viewing. Write today for Catalog No. 56485.

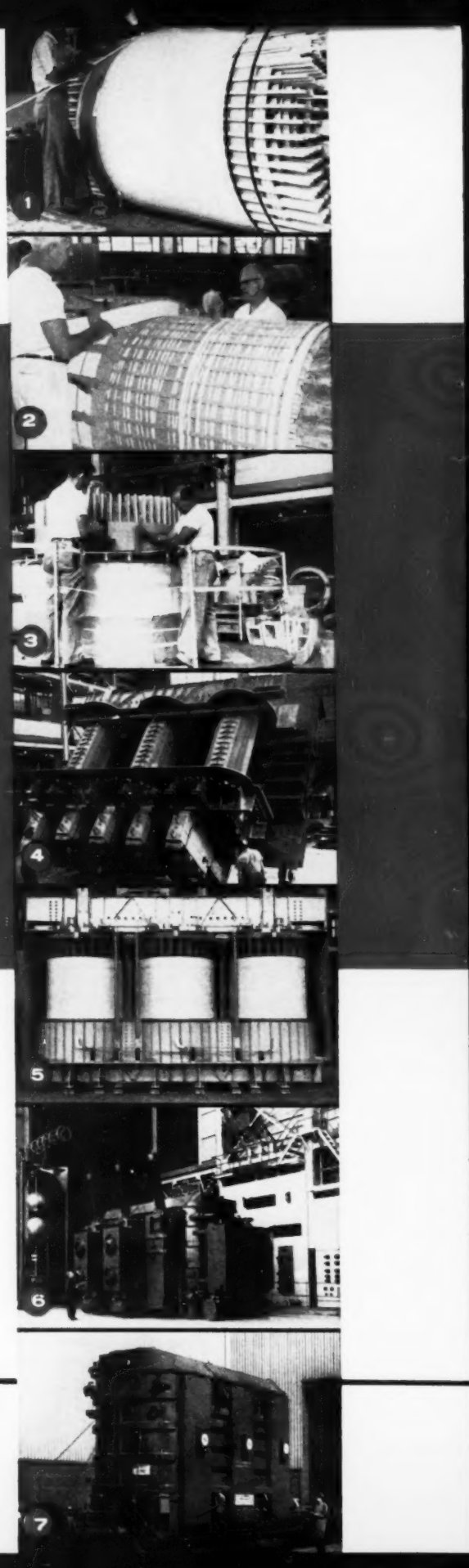


HAMILTON WATCH COMPANY
HATHAWAY INSTRUMENT DIVISION
5800 East Jewell • Denver, Colorado

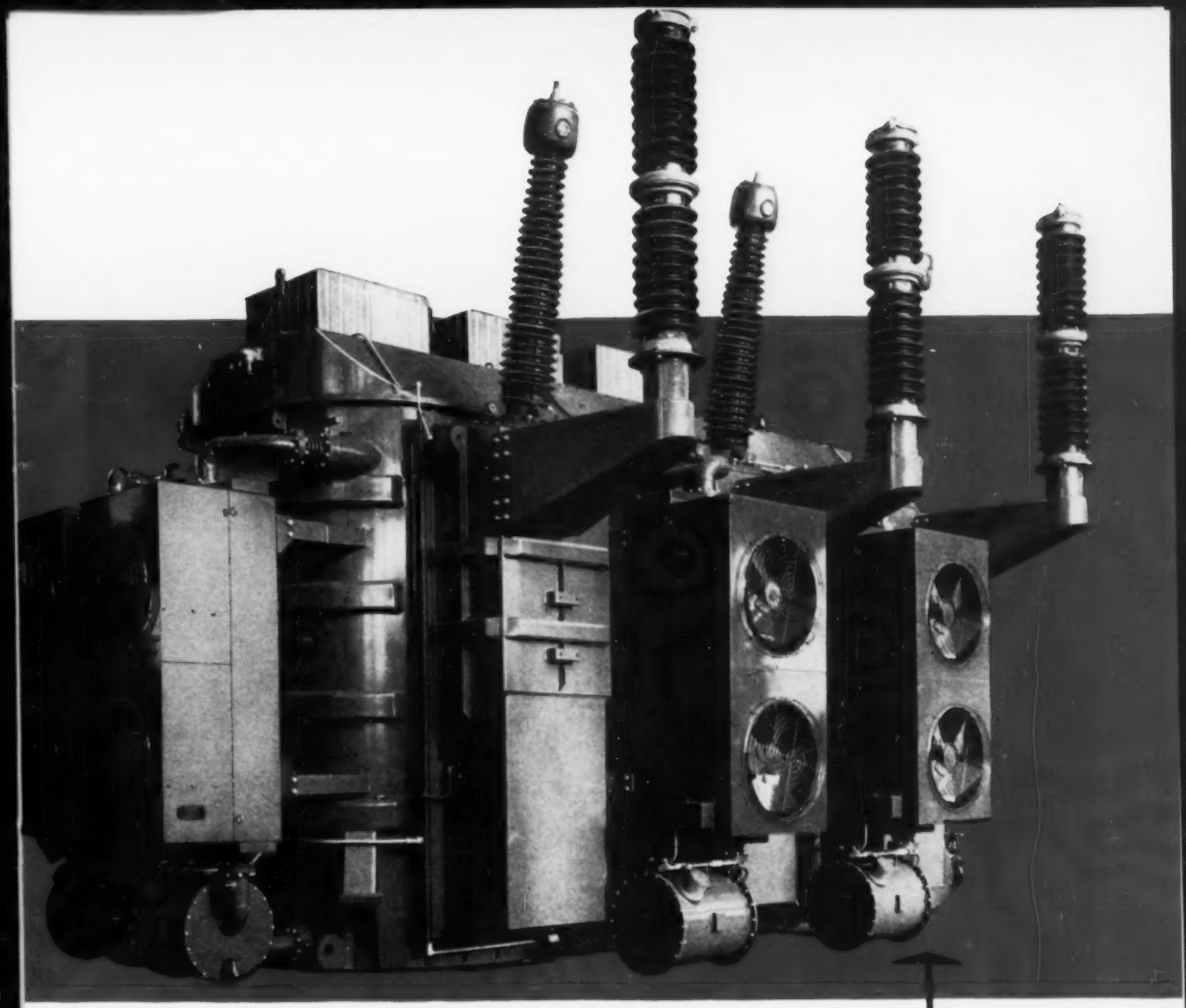
STEP
BY
STEP
TO A

217,000 KVA, 230 KV TRANSFORMER

for POTOMAC ELECTRIC POWER COMPANY'S DICKERSON GENERATING PLANT



1. Winding High Voltage Coil
2. Winding Low Voltage Coil
3. Flanging High Voltage Coil
4. Raising Stacked Core
5. Low Voltage Side of Core-and-Coil Assembly
6. Testing Completed Transformer
7. Shipping Transformer



This power transformer is now installed at Potomac Electric Power Company's new 55 million dollar Dickerson Generating Station, located on the Potomac River in Upper Montgomery County, Maryland. The unit is a 217,000 KVA, three phase, type FOA, transformer having a high voltage rating of 234,000 Grd. Y/135,000 volts, with 2-2½% no-load taps above and below normal and a low voltage rating of 13,500 volts delta.

The transformer is connected through isolated phase bus duct to Unit #1, a 175,000 KW generator, which is the largest generating unit on the PEPCO system. The generated voltage of 13,500 volts will be stepped-up to 230 KV for transmisson. This transformer is an important link in the PEPCO system, and it exemplifies Moloney's ability to build large power transformers of any type or rating to customer's exact specifications.

For additional information on the engineering ability and facilities which make Moloney particularly well-qualified to build large power transformers, contact your Moloney representative. Specify Moloney Transformers . . . All Along The Line. MEDO-5

Factories

ST. LOUIS 20, MO.
TORONTO, ONT., CAN.

Sales Offices

ALL
PRINCIPAL
CITIES

MOLONEY ELECTRIC COMPANY

Transformers For Utilities, Industry, and Electronic Applications

MOLONEY M ELECTRIC

A cool, clean electric kitchen is included in the purchase price of every Medallion Home

This is Mrs. C. R. Campbell of Fullerton, California, in her all-electric Medallion kitchen

MEDALLION HOME
LIVE BETTER ELECTRICALLY

Help for wives: An all-electric kitchen is at your service the moment you move into your Medallion Home. The latest range-and-oven gives you a *clean* helping hand, important free minutes, a kitchen climate that's 16° cooler. And your Medallion Home affords the creative lighting you've always wanted – assuring you comfort, beauty, safety.

Savings for husbands: The appliances in the all-electric kitchen of your Medallion Home are already taken care of in the basic home cost. And your home is thoughtfully planned for full Housepower – wired for tomorrow's power needs as well as today's. Further, a Medallion Home is a *wise* investment. For, in a future that's all-electric, your Medallion Home will remain electrically modern.

Beyond all this is the Gold Medallion Home – the ultimate in living better with electricity. It's completely electric. And you have a wide choice of new electrical home-heating methods. One is the amazing electric heat pump... it *cools* your home without water, *heats* your home without flame.

SOUTHERN CALIFORNIA Edison COMPANY *helps you* LIVE BETTER–ELECTRICALLY

ELECTRICAL WEST SPOKESMAN FOR MOST HIGHLY ELECTRIFIED REGION OF THE U. S. VOL. 123, NO. 4 OCTOBER 1959

Making a Sale, Managing a Job, Doing the Work — All Three Are Done by People

Ralph Johnson, Sturgeon Electric Co., Denver*

". . . we could all improve our feelings in proprietorship towards our men. They really are our men."

Because of our diversified interests, attitudes, abilities, perspectives and over-all capacities—our individual electrical contracting businesses vary in nature quite widely; but in one respect we are all identical. Each of us is operating a service business and, as such, personnel is a most important consideration.

Personnel administration usually includes employment, training, contract labor relations and public relations as its principal elements.

Many of the problems that ordinarily accrue to the personnel department of a manufacturing concern are handled by our joint NECA-IBEW functions; and notwithstanding the many other advantages that accrue from NECA membership—this is of the greatest value to most members.

Please don't confuse labor relations with personnel management. One is a matter of policy relations—the other a function of direct personal contact. Nobody except the contractor himself can do the latter job.

Personnel management is defined in NECA Study Unit No. 6 as "the process of establishing and maintaining a satisfactory relationship between management and personnel which results in a satisfactory performance of the work required, in the minimum time, consistent with all influencing factors."

Briefly then our problem resolves itself into the question of maintaining relationships with our men which result in a maximum of quality, productive man-hours of electrical construction work.

The people involved in job management are the contract managers or engineers and the field electricians —consisting of foremen, journeymen and apprentices.

What are the elements that are involved in getting to the final objective of installed work ready for operation?

1. **The business itself.** Before any work is done a sale is made.

2. **Planning, design, engineering,** purchasing, warehousing, provisions for the management of the job itself.

3. **Field installation work.**

None of these three elements deserves more promising position in the over-all picture than the other. None makes a greater contribution to the final objectives than the other.

Thus you can see the only individual directly involved in job management from the office personnel is the contract manager. Indirectly the purchasing agent and the warehouse are heavily involved. Engineering also shows up continually. But for the purposes of this discussion our remarks will be directed to the management by the contract manager.

At this point we should recognize that all electrical contracting businesses are not constituted the same. Therefore, our terminology may apply to some in a little different way, but the basic principles are the same even if the president of the company himself manages the job.

Manager's Responsibilities

What are the contract manager's responsibilities? He must:

1. **Prepare a complete construction plan,** together with complete construction details of installation.

2. **Prepare a complete bill of materials**—with all items ready for purchase and scheduled for delivery.

3. **Collaborate with the general contractor** and prepare a complete manpower requirement schedule according to the progress schedule of the job.

4. **Determine the tools and methods** required for the installation.

5. **Select and supervise the job personnel.** This includes the training of apprentices.

6. **Act as liaison with the owner,** architect, general contractor and other crafts, including the handling of change orders, etc.

It almost sounds as if this guy must be the contractor himself. Nobody else seems to be required. But is that so? Not by any means. He didn't sell the job, estimate it, purchase the material, worry about the pay

*A talk at NECA Tri-District Convention, Glacier Park Lodge, June 24, 1959.

roll, stock the material or install it.

You bet, he's a real key man but he also requires managing.

What can we do about usurping his responsibilities? To accomplish everything that's required, this man, like all other humans, must have some objectives, such as the following:

1. **To compete with the contract price.** It must be realistic. He should have a continuing race with the weekly cost reports.

2. **He must feel that he has someone else with whom to share his problems.** The general manager or owner must be thoroughly conversant and sympathetic with them at all times.

3. **He must be well trained in all elements of personnel administration** as they relate to the workers, the public and the industry almost to the extent that he is in a popularity contest.

4. **His principal task is to set the stage** so the men on the job can work if they choose to do so. They must have information, tools and materials synchronized with the progress of the job. This must be impressed indelibly on him as his mission of service.

Operating Plan Needed

It is top management's responsibility to give him a plan of operation and a fine operating organization to back him up.

What sort of a plan?

1. He must have a method, for example, of scheduling and releasing material for delivery to the job.

2. He must have adequate, modern tools and methods to use on the job.

3. He must have good warehousing facilities on the job.

4. He must have a means of communication that permeates the entire cycle of operation from the designer, estimator, purchasing, warehousing, to the man on the job —with a complete understanding of the detailed requirements. Since he is only part of the complete cycle, this must be provided him by the management.

Given these things, management has every right to expect performance. And when he performs, he should properly share in the profits. When he doesn't, both he and management should be informed promptly and accurately through proper reports.

He must know that management knows exactly where he stands at all times.

The other direct personnel element involved in job management is in the field personnel itself. This includes foremen, journeymen, linemen, operators, apprentices, groundmen, etc. My remarks will be directed to this group as a whole.

To return to the NECA definition, management of these people involves maintaining a satisfactory relationship which results in a satisfactory performance of the work, in a minimum of time.

Why do men work? Many years ago Frederick Taylor showed that a better arrangement of work made it possible for a laborer to quadruple the amount of pig iron he could move in a day, but history proved that the better work methods were practical only to the extent that they were acceptable to the worker himself.

In order for men to work, these conditions must be satisfied.

1. They must **desire** to work.

2. They must have the **ability** to fulfill that desire.

3. The proper **information, tools** and **material** must be available as required so they can use them.

Then, to accomplish the desired end so vital to our business, our job in management in order to secure these productive man-hours must be to accomplish these three aforementioned conditions in reverse order:

1. To train men thoroughly to accomplish effectively electrical work of all kinds.

2. To provide information, tools and materials as required for it.

3. **To create the desire to work.**

To train men thoroughly as contractors we must realize that the destiny of this industry is in *our* hands. To elicit and sell IBEW on cooperation is mandatory but *we* contractors control the future. Contractors must train men and plenty of them. We should do a much better job than we are doing. For the most part our program is good if the quantity of men trained was right. But it is woefully deficient.

During the past two years, the total *working* membership of IBEW-USA has not increased.

During that same period of time, the demands for our electrical services increased at the rate of 5% per year.

Also during that same period of time, a recession occurred which reduced the number of apprentices in training below the immediate prior years.

Concurrent with all this are predictions that 1962-63 will be boom years—which imply excessive electrical demands. If we started to train men *last* year they would be available for the boom—but we didn't.

All of this is most alarming to contemplate — for a businessman whose very future depends on trained manpower.

Successful management must attempt to forecast the future. Five-year budgets are commonplace. Since it takes four years to train an apprentice, *now* is the time for action.

Creating the Desire to Work

How can we create the desire to work?

Two very important factors are in our favor:

1. The psychological effect of working on a contract.

2. The tremendous impact of being in a type of work where men can share in the thinking required to produce the results.

The easiest thing to do on the job is work. The vast majority of men prefer to do so—especially under the incentives of a contract. Contract work provides a driving impulse. In fact, our entire organization functions much better under contracts. We are fortunate that the nature of our business provides this and we don't have to create it.

Point 2 is in our favor in that our employees work independently for the most part and are forced to think for themselves.

The Stanford University Press in a recently published book entitled "Why Men Work" forecasts that the working people in our country must be given an opportunity to participate in the thinking that relates to their work or our present system as we know it may be doomed.

It is reasonably obvious to all of us that maximum production is secured by incentives. Even when a man works for himself, his goals are significance and pride.

Piecework, profit sharing, the lust for increased standards and hunger for status, the hope of being their own boss—all of these things inspire men to work, but "any move toward harnessing the thinking of the whole team as a basis for intelligent decisions by the team captain, is a move for higher efficiency, and the preservation of both our material standards, and our democratic political standards," to quote this Stanford report.

"The economic way of life which is essential to our political democracy must be built upon the same human foundation. **Workers who are denied the experience of thinking about their work will not be competent thinkers at the ballot box.**"

"The common denominator in all the situations in business and in-

dustry where teamwork has been achieved is the **opportunity for the average worker to share in the task of thinking.** Here the answer has been found as to why men work."

We are all probably more or less guilty of tossing the job plan to a journeyman with no layout, no bill of materials, no tool list—and of expecting him to do the job. Here is maximum opportunity for him to inject his thinking into his job. But in so doing we are defaulting our responsibility to him as a contractor because our lack of personnel management is showing.

He has to think just as hard in making the installation with a designed plan, installation details, bill of materials and tool list as he would have otherwise.

The Right to Think

Nevertheless—for this broad system to be complete — management must believe in the right of workers to share in the task of thinking and planning and, above all, the acceptance of workers into the thinking partnership must never be artificial or dramatic.

Important devices to stimulate thinking include suggestion boxes, questionnaires, workers' forums and labor-management committees, of course.

Toward the end of creating the desire to work, the balance of our field personnel relationship may be likened to an American officer commanding foreign troops. The men would accept, but their inward loyalty would be elsewhere, and most of their thinking would be directed toward escape in some form.

Under union conditions nearly all forms of incentives have been denied us in our relationship with our field employees. Any that exist accrue mostly to the benefit of the union itself.

If an attempt had been made to create an atmosphere for the most undesirable relationship conditions possible—a better job could not have been done.

We have the distinction of being brokers—our contracts are an arm's length transaction.

Most of this situation is the result of our inheritance but it doesn't need to remain this way and we should take steps to overcome it. This can be done without jeopardizing the men's union relations in any way whatever, but the steps must be taken by each of us individually.

As a step in this direction, we could all improve our feelings in proprietorship towards our men. They really are *our* men. We train them — pay them — find work for them; but I don't believe they will ever look to us in the proper light unless they feel deeply a sincere interest on our part. This sincere interest may be manifested in many ways — birthday remembrances, sickness remembrances, Christmas remembrances, company picnics, family interests.

But above all, the feeling that they are one of us and that they have a pride in our company is needed. Permanency of employment for our field forces has always been one of my management objectives.

At the start of our business year, our firm makes up a budget, trying to forecast sales and developing our pricing structure accordingly. It has often occurred to me that nothing could happen to our industry that would be as helpful as this—a condition whereby each contractor would have his self-determined quota of men to keep busy. He would bid, sell or otherwise secure work to keep them busy, and he couldn't bid an excessive amount of work—just enough.

He would plan his entire operation because there could be no deficiencies or excesses.

Thus he could build a highly integrated working unit of his people. It would be personnel management in action.

In public relations it is known that every employee is our front line of public relations contact. This is quite a contrast to our present system wherein not any of us has a specific responsibility, no training or organization in public relations.

Our manpower requirements run from 0 to 500 in a matter of weeks. Everybody bids everything. Nobody sells anything. Our men are dispatched to us as we need them, but they belong to the union and besides they are not *our* men.

Every year, higher wages are forcing us to take all measures to save time, but is it possible that we may have been overlooking one of our most important weapons—**our own personnel relations** which could result in a sincere feeling on the part of our men to produce quality, productive manhours of work so greatly needed.

"HOT STICK" SHOW AT OREGON CENTENNIAL by line apprentices Howard Love and Jerry Lilly, on pole; watched by George Schetky, Western Electrical Construction; Eugene Ridenour, Northwest Line Construction apprentice director; Roland Blantz, Portland General Electric training director; Francis Rothery, PGE hot stick trainer; Robert Taylor, business representative, IBEW Local 125; Paul Keller, Pacific Power & Light employment manager; and Si Jarvis, business representative, Local 125. Fifty apprentices and committee members participated in the apprenticeship booth in the centennial grounds. The seven-day live demonstration show was played to hundreds of spectators under the auspices of the Joint Apprenticeship & Training Committee of the Northwest Line Construction Industry and the apprenticeship committees of the Pacific Power & Light Co. and Portland General Electric Co.

The Sikorsky craft moved a yard of concrete in three trips—just a matter of minutes

Pioneering Work: Edison contributes generously to transmission construction know how. In an on the job report, here is the answer to your question . . .

WHAT ARE COPTER COSTS?

JACK D. ROBINSON, Engineering Editor, Electrical West

Western construction engineers have been quick to see the advantages of pole and power line construction using helicopters as a sky hook.

They see the clear and tangible advantage of not having to construct roads and make right-of-way access arrangements.

They also see the possibility of building lines in more rugged country, easing the right-of-way problem and keeping the lines as far from the public eye as possible. They recognize that inherent in helicopter construction is the opportunity to utilize the terrain to minimize the number of towers. But these advantages, while real, are peculiar to each job and, at best, difficult to assign a dollar value.

In recognition of these merits, Southern California Edison Co. has undertaken a series of experimental helicopter construction jobs. They have directed their attention to (1) developing knowledge and experience in copter construction techniques and (2) establishing realistic costs based on the best methods that can be developed. The costs shown on these pages are the best and perhaps the only valid figures the industry can use to evaluate this intriguing new capability. Edison has not taken this research program lightly. Under the direction of chief construction engineer O. N. Kulberg, they have completed estimates and planning necessary to give the chopper a "fair day in court." They have spent the money to gain experience. In addition, they have retained Brig. Gen. F. R. "Fritz" Payne, a distinguished marine helicopter commander, to bring his service know-how to direct and evaluate the choppers' performance.

Helicopter Costs for Tower Construction (No Construction Labor or Material Included)

JOB FUNCTION—		Cost	Cost/Tower	ANALYSIS	Estimated Savings	Estimated Optimum Cost
1, 2, 3. LAYOUT SITE PREPARATION AND EXCAVATION (G2 Helicopter): Transporting personnel, tools, reinf. cages, air compressor (approx. 250 lb.) Generators and equipment to tower sites for excavation and placing 60 tower footings. Includes engineers for layout and inspection				Use of light portable compressors, new explosive techniques for excavation, install field phones for communication in mountainous terrain, improved air-ground communica-		
182 hr, 23 min at $68/hr		$12,398.22				
Cost/Tower (4 footings)			**$ 824.00**	tions	$324.00	**$500.00**
4. PLACING CONCRETE (S-58 Helicopter): Transporting concrete						
231 cu yd, 462 tons	55 hours					
Transporting concrete hopper, table and chutes	5 hours					
Transporting air compressor and cages	1 hour			Possible use of lighter bucket—15% saving in delivery cost, improved handling, hopper and associated gear, improved planning through experience		
(average round trip of 3.3 miles)						
Flight hours	61 hours					
at $300/hr.		18,300.00				
Cost per cu yd	79.20					
Cost per ton (462 tons)	39.60					
Cost/Tower (4 footings)			**1,220.00**		420.00	**800.00**
5. TOWER ERECTION (S-58 Helicopter): Weight of steel	112 tons					
Transport steel, personnel, insulators, hoists, gin poles and miscellaneous material						
39 hr, 46 min		11,930.00		Improved bundling of steel, more experienced crews		
Cost/ton	$106.00					
Cost/Tower			**200.00**		30.00	**170.00**
(G2 Helicopter): Transportation personnel, tools and material for erection of steel						
93 hr, 4 min		7,647.13		Coordination of helicopter, layout		
Cost/Tower			**509.00**		109.00	**400.00**
6. STRING SAND LINE	30.5 miles	680.00				

Payne recognizes that economic justification involves the all-or-nothing use of rotorcraft to replace access road transportation. It is swallowing the whole job by air that requires re-evaluation of the methods and materials for every prosaic task. Says Payne, "Air time and pay load have been my masters for a long time." Already a variety of sub studies are under way developing construction techniques for airborne builders. For example, newly available explosives may replace heavy compressor equipment in excavating for footings.

How the Job Was Planned

	Conventional Const. Methods	Bell G-2 Helicopter	Sikorsky S-58 Helicopter
1. Tower layout		X	
2. Brushing and benching		X	
3. Excavation		X	
4. Reinforcing steel		X	
Place concrete			X
5. Deliver tower steel and hardware			X
Assemble and erect towers		X	X
6. String sand line		X	
7. Pull in and sag conductor	X	X	
8. Install armor rod, clip conductor, install B&B guards, signs, and clean up		X	

Early Experience

In an earlier experiment, Edison teamed up with the Sikorsky Division of United Aircraft Corp. to determine the feasibility of helicopter construction (EWEST, March 1958) and to get a first shot at costs. During this joint study an accurate record of operating costs were kept to determine costs on an owner-operated basis.

It was not felt at this time that costs were sufficiently refined so an ord of operating costs was kept to test results of the first study.

Recent Work

A five-mile section of the Saugus-Santa Clara 230-kv line was selected for another study in which, to add realism, Edison contracted with helicopter operators on a straight commercial basis.

The only part of the construction job that employed conventional methods was pulling in and sagging of the conductor. This is because present day rotorcraft cannot handle the 10,000-lb conductor reels or pull through and sag the conductor. The map shows the test section and the locations of roads which made it possible to pull in through the inaccessible areas. Previous studies have indicated that tensioning and pulling equipment can be supplied for easy knockdown and reassembly for air lift. The assumption is that this phase of line construction will fall into line *if* the choppers prove out in the yeoman task of hauling concrete and steel.

The job is lined out in the table indicating which of two helicopters was used to perform each task.

The other table shows costs associated with these tasks including a summary of the costs for each construction job in dollars per tower, as well as the method changes that the job indicated. The final column indicates costs that might be expected on a subsequent job using the improved methods and being free of labor difficulties.

An unhappy and unfortunate outgrowth of this study was an electricians' strike lasting 38 days against the principal contracting firm. Since the large Sikorsky S-58 was leased, the disturbance threatened the entire study. On return to work the feelings generated by the stoppage seriously twisted the results. Vic Carroll, Bechtel construction superintendent on the job, said, "Watch those two towers — the one on the right will be finished tonight—but I may not live to see the other completed."

Thus costs through the completion of foundations appear to be representative. However on jobs such as tower construction where the choppers were used mostly for personnel transportation, the unsettled labor conditions materially added to the time required for tower assembly and erection and hence the amount of helicopter transportation time required.

In addition to the strike and resulting problems, the job was plagued by communications difficulties and failure of portable two-way communications forcing the small helicopter, on occasion, to become a $68-per-hour messenger boy.

All told, the measure of the tangibles—helicopter costs vs access roads costs — show helicopter transmission construction breaking even with conventional methods, with appreciable savings in pole line construction in difficult terrain.

The growing public relations pressure for "invisible transmission lines" and the improved capabilities of rotorcraft now under development seem to bode well for the future of the helicopter in transmission line construction.

On the job site, the helicopter hovers over concrete bin. A workman, in view of the pilot, signals when the ship is over the chute and the release cord is pulled. Mountains in the background indicate the kind of terrain

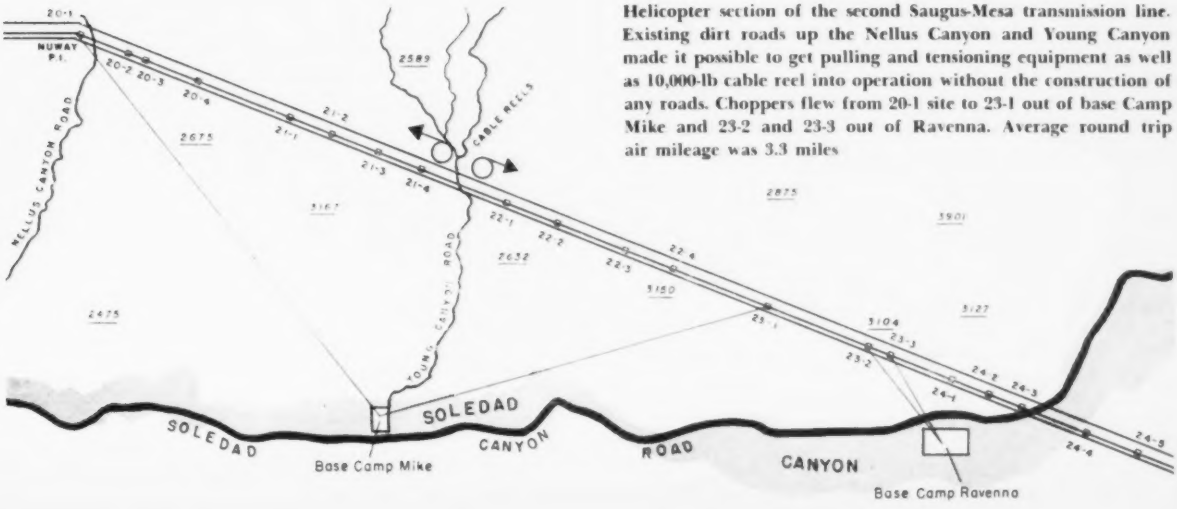
On the site, men use portable vibrator and hand tools on footings

With footings completed rotorcraft begins to haul bundles of steel to tower site

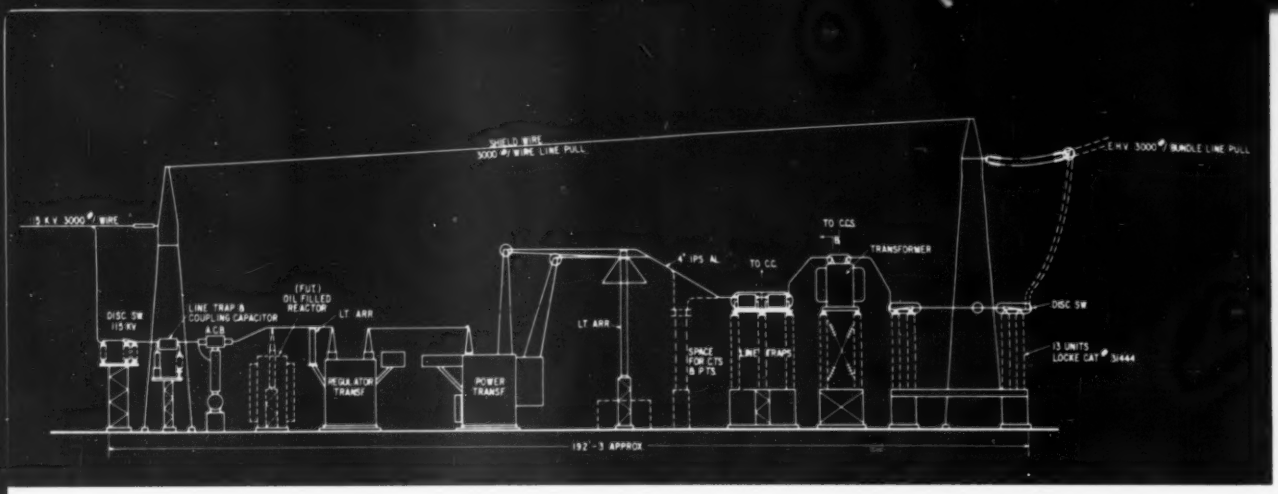
The Bell craft, capable of moving a payload of 600 lb, brings in small hardware items. Here a superintendent confers with the job foreman. The personal look-see was necessary because communications had broken down

Workmen who have been flown in by the small Bell craft break down steel bundles and begin assembly of tower components on the ground

With sizable pieces of the tower preassembled on the ground, the Sikorsky craft hoists the gin pole into position and the tower begins to rock



Helicopter section of the second Saugus-Mesa transmission line. Existing dirt roads up the Nellus Canyon and Young Canyon made it possible to get pulling and tensioning equipment as well as 10,000-lb cable reel into operation without the construction of any roads. Choppers flew from 20-1 site to 23-1 out of base Camp Mike and 23-2 and 23-3 out of Ravenna. Average round trip air mileage was 3.3 miles



750-kv profile of the future! Here is a report on the new technology that is going into the design of EHV components —and why these developments show favorable EHV transmission economies.

Progress on Project EHV

J. G. Anderson, Research Engineer–System Insulation, General Electric Co.

Interest and activities in the field of extra high voltage (EHV) are increasing at a tremendous rate. At the present time, at least six utilities in the United States and Canada are giving serious consideration to expanding their system capacities with transmission at 460 kv or higher. Many more are actively engaged in investigations or design of facilities for study of the electrical and mechanical characteristics of EHV transmission lines of 345 kv or higher that they expect to build in the near future. Many of these utilities have particular transmission problems to overcome, requiring special cost or mechanical data that would not be available in time to meet their schedules if they did not develop their own research facilities to some extent. However, it is not reasonable to expect all concerns that enter the EHV field to spend large sums of money on research to answer general problems. Much of this work can best be done by a centralized facility that examines the problems of EHV transmission on a broad scale. This is the purpose of project EHV.

Plans and Objectives

To meet the need for EHV research and to obtain operating experience with EHV equipment, the General Electric Co., in cooperation with several participating companies, has initiated Project EHV. The project will cost the General Electric

Participants in Project EHV

General Electric Co.—15 departments supplying all power apparatus and insulators (except for the measuring equipment) and designing the terminal stations

Aluminum Co. of America—All aluminum for terminal stations, line conductors and three aluminum towers

American Bridge Division of U. S. Steel—All design engineering for the transmission towers and steel fabrication

Anchor Metals Inc.—Steel towers

Petersen Engineering Co.—Tension stringing equipment

Stone & Webster—Engineering specifications for line and stations, and all construction

Rilco Laminated Wood Products and **Weyerhaeuser Timber** Companies—One laminated wood 650-kv tower

Western Massachusetts Electric Co.—Supply power and later operate the line as an integral part of its system

Brewer-Titchener Corp.—Forgings for corona shields and other hardware

Project EHV—Present Status

Oct. 1, 1959—Energizing 115-kv side of North Station for instrument tests

Jan. 1, 1960—Final deliveries of steel for short section of line

March 15, 1960—Delivery of EHV apparatus for North Station

May 15, 1960—Energizing short line at 460 kv. Start foundations for South Station

Nov. 15, 1960—Energize long section of line and aging area

Jan. 1, 1962—Start operation as closed loop with Western Massachusetts Electric system

Jan. 1, 1963—Start operation as integral part of Western Massachusetts Electric system

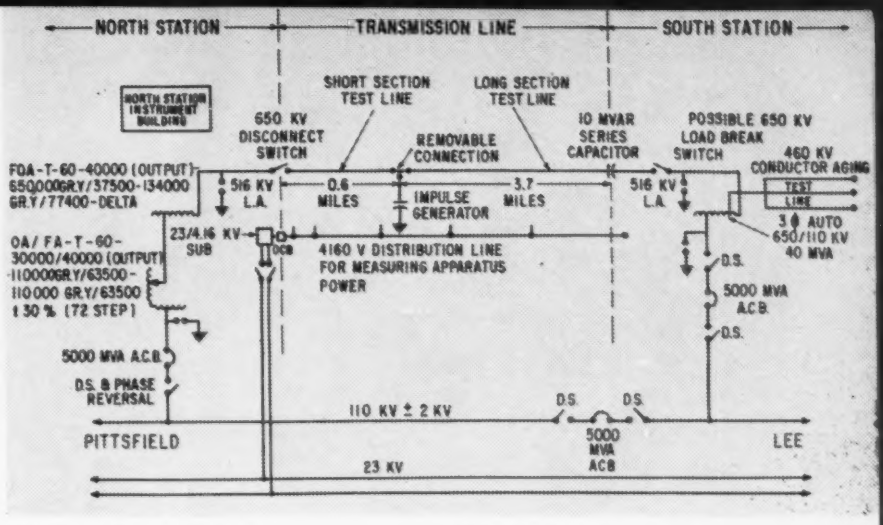
Co. alone $7.5 million. It involves the construction and operation of a prototype transmission system at voltages from 460 kv to 750 kv. Because of the flexible design of the system and the large quantity of electrical and mechanical measuring instruments to be employed, this project should supply much needed data on corona loss, radio noise, mechanical and other characteristics of EHV lines. In addition, it is expected to furnish performance data that can be applied to lower voltage systems for cheaper and more efficient designs.

This paper is a progress report on Project EHV. It is an outline of some of the concepts that have evolved from the preliminary work, and a tabulation of the laboratory and field studies that have been completed to date.

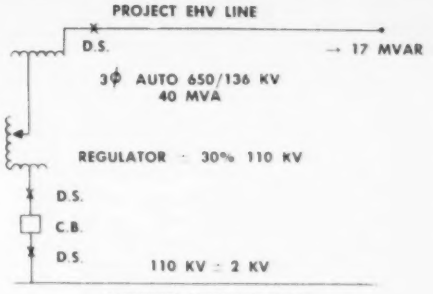
The EHV Facility

The transmission line is 4.3 miles long and runs along the Housatonic River Valley. It will include 17 towers, utilizing steel, aluminum and wood construction. The longest span will be 2,200 ft. This size was selected to be the smallest rating consistent with actual power transformer practices for size units that would be required for a 750-kv line. The northern terminus, called the North Station, will connect the project to 110-kv power from the Western Massachusetts Electric Co. The North Station will include some very unusual features. Incoming power will be stepped up to the desired test voltage by means of a 110 kv ± 30% regulating transformer and a 40-mva three-phase autotransformer rated 650/136 kv. The high voltage side is designed for very low radio noise, so that more accurate radio noise measurements can be made on the transmission line itself. For that reason, the high-voltage bus is 4½ in. diameter aluminum tubing, and larger than normal corona shields are to be installed on most of the apparatus. The lightning arresters will be rated 516 kv (75% arresters for a nominal 650-kv system) and will be the highest rated in the world. They will provide adequate protection for the 1,925-kv BIL transformer and other equipment on the high-voltage bus.

Several special coupling capacitors and instrument transformers are to be installed for high-voltage bridge measurements of line corona loss, and the line current is to be measured by a special high-voltage shunt whose output voltage is to be radioed back to ground by a small radio transmitter. This was found to be necessary because a current transformer was not accurate enough for the extremely high power factor loss measurements which must be made for line corona loss studies.



Above, one-line diagram of Project EHV system, showing ratings of major components. One line, right, shows section of the system that will be in place for open-ended operation during 1960



The four-pole vertical-break 650-kv disconnect switch will also be the world's largest, supported on insulator stacks about 16 ft high and having an open gap of about 17 ft. A four-pole switch is necessary because a circulating current is to be used in one of the phases. This circulating current is fed down one-half of the conductors of one phase of the bundle conductor transmission line and returned via the other conductors of the same phase. In this manner, **large conductor currents can be achieved by the use of only small kva and the conductors can be heated to the temperature that they would reach on a 650-kv line carrying as much as 2,500 mva of power.** Measurements of corona loss and radio noise can then be made as a function of conductor temperature.

A research project is highly dependent on its instrumentation, and Project EHV will be heavily instrumented. As now planned, about 250 measurements of the electrical and mechanical performance of the system will be made automatically every 15 minutes, and on demand every minute. The data will include mechanical stresses, meteorological effects, conductor temperatures, corona losses, radio noise at five observation stations, and many other variables. Since it is practically impossible to process such a flow of data manually, the data are collected in analog form, digitized, and coded on punched paper tape at the North Station for processing on an IBM 705 computer.

In addition to the automatic data processing, 24 oscillographs will record lightning and switching surge data and 60-cycle effects. This number includes one oscillograph on every tower for lightning stroke records, and three oscillographs in each station. An oscillograph on every tower is practical because a low-voltage distribution line runs parallel to the main test line and is used as a power source for the oscillographs and all the line instrumentation.

Construction Starts

Orders have been placed for most of the equipment, clearing of right-of-way for the short line has been completed, and construction of the North Station is in progress. The start of construction is most significant for its signals the completion of the theoretical and laboratory studies upon which the design of the system will be based. The test and

Typical of the laboratory work required to design the EHV system are geometrical tests that determine the tower lightning response

operation of the line will serve to confirm or modify technology already required for the construction of the line. For example, the lightning response of the line has been determined in advance by means of geometrical models and millimicrosecond instrumentation shown in the attached photo, and several new methods of making lightning measurements are in the final stages of test. Computer programs have been devised for the advance prediction of line radio noise and for the most economic selection of line characteristics and conductors. The instrumentation for making the high voltage corona loss measurements has been tested on an actual operating line. The line hardware and tower design are in the advance stages.

Design Concepts

A study of the insulation requirements of systems rated 460 kv or higher has indicated that EHV systems will not be merely extensions of present day systems. Present day limitations become less important, and factors of no concern today are key design criteria. For example, towers for 460 kv are not likely to be appreciably higher than those now employed at 345 kv. And since a 460-kv line is likely to be single circuit, the tower may have waist-type construction and thus be considerably lower. As has been demonstrated theoretically in several papers and as measured on geometrical models of lines, the lightning voltage created across a tower insulator is almost directly proportional to the conductor height above ground, all other things being held constant. In this case, the lightning voltages developed across the 460-kv tower insulators will be no higher than the voltages across the present 345-kv lines. Most present 345-kv lines in regions of high isokeraunic level have 18 5¾-in. insulators, and although some excessive lightning trip-outs have occurred on lines with one ground wire, all present indications are that if these lines had two ground wires the trip-out rate would be completely satisfactory. For these reasons, **one could assume that a 460-kv line of similar or lower construction need have no more insulation than a 345-kv line for satisfactory lightning performance.** However, because the steady-state voltage on the insulator can add to the lightning voltage, a small increase in insulation is required for 460 kv. Thus two 5¾-in. insulators have been added for towers having a footing resistance under 10 ohms and either two ground wires, or one ground wire with a shield angle of 20° or so. Thus, all present indications are that a 460-kv line can be built with only slightly greater insulation requirements than a 345-kv line from the viewpoint of lightning trip-outs. The projected tests will provide definite answers to these questions and further improve the already extensive know-how of General Electric and the other contributing companies.

Switching Surges

When the insulation analysis was extended to include effects of switching surges, it immediately became clear that little was really known about this aspect of line insulation at extra high voltages. Laboratory data on the switching surge strength of line insulators and air gaps were badly needed, and field data on representative wave shapes of switching surges were also required. After some study, it was decided that switching surge voltage wave shapes having a gradual rise to crest value in either 100 or 1,000 microseconds and a long decay to half value in 4,000 microseconds or so were reasonable waves for tests. Using these waves, extensive wet and dry switching surge and impulse and 60-cycle tests are being conducted on long string insulators up to 60 5¾-in. units in some cases and on simulated gaps between line conductor and tower wall or tower crossarm. These tests are still in progress. At present, it can be said that all data obtained indicate that it is the **switching surge strength of an EHV line that is the dominant factor in transmission at 460 kv or higher.** This is in agreement with recent conclusions in other countries, and marks an important departure from the previous approaches used in insulation design of lower voltage lines where lightning performance was the basic criterion.

New Knowledge

When the switching surge strength of an EHV line determines the insulation required, it is important that any such line design be checked by transient analysis and model techniques to determine in advance the possible switching surge voltages that will be produced. This, in turn, will depend on the nature of the circuit breakers to be used. Here, the air circuit breaker has an important advantage over the oil breaker in its lesser tendencies to restrike. By careful control of switching procedures and by use of proper circuit breakers, it appears that considerable savings in EHV line insulation may be possible in comparison to those expected if present 345-kv practices are extrapolated to the higher voltages. For example, the Project EHV line is to have only 22 5¾-in. insulators for transmission up to 500 kv, and 30 for transmission in the 650-750-kv range. The corresponding phase-to-phase spacings are 38.5 ft for the lower range and 45.5 ft in the 650-750-kv range.

The results of this research project will give the industry much new knowledge that can be used for further improvements of EHV apparatus. This wealth of experience in EHV transmission should be of great value to the electric utilities.

Deane Van Noy, president of Stinson, poses next to first production model

Despite publicity, orders, Stinson electric car . . .

Runs Out of Gas

Stinson Aircraft Tool & Engineering Co. is all through as a manufacturer of electric cars.

Company officials, who six months ago were confidently talking of a 20,000 production goal in 1960, now admit that production has stopped at the San Diego plant and never will start again.

Anxious to preserve what they say is a $250,000 investment, Deane Van Noy, president, and Dr. Charles Graves, vice-president, are in the midst of negotiations that may:

1. Merge Stinson with a major auto manufacturer, which they won't identify, and phase them out of the electric car business.

2. Reorganize and issue stock in a new company, which would control overseas manufacture of the car.

3. Fail and bring the latest electric car experiment to an end.

In any event, all but one of the electric utilities that ordered a total of 110 cars will have to wait at least a year and maybe forever.

One car was delivered to the Atlantic City (N. J.) Electric Co. It ordered four.

There are 15 running models at the San Diego plant, but these won't be worked on until negotiations take a firm direction.

What Happened?

What happened to Stinson and its product, the Charles Townabout all-electric sportscar?

First, the car never really solved the problem that always has been a bugaboo of electrics—range. The best batteries that could be developed produced a range of only about 77 miles without recharging. This seriously limited chances for commercial sales, particularly at the asking price of $2,800.

Second, labor costs were too high. Stinson is in San Diego, a labor-shortage area, and is competing with established and wealthy aircraft plants for manpower.

Third, vendor costs were deceptive. First cars cost more to assemble than their selling price. Officials said subcontractors would not produce desired quantities at prices that were originally quoted.

Fourth, Stinson's own management was inexperienced. Van Noy is a veteran machine shop operator, but is not an electrical engineer. Graves is a dentist who has experimented in physics and electricity and holds several patents on a toothbrush.

As Graves said: "We never knew what we could do until we tried."

The chief bugs in the car involved weight distribution, the electrical control system and, of course, the batteries. First fiber-glass bodies were poorly built and had to be redone.

Happiest surprise was the motors. They cost less than expected.

With all these obvious drawbacks, how has Stinson lasted so long?

Interest in the car is tremendous. More than 10,000 letters, many containing checks, arrived at the San Diego plant. An imposing list of utilities and electrical firms ordered the cars for promotional purposes and agreed to help in testing it—although none paid ahead of time.

Atlantic City, through its president, Bayard L. England, and a director, H. Drake Harkins, provided support and inspiration.

And Stinson had a prototype—actually a Volkswagen Karmann Ghia with an electric motor—that provided a publicity gimmick which gave the impression of a production model.

Those closest to Stinson always had reservations. San Diego Gas & Electric Co., while officially silent, never ordered a car. And the company fired off an immediate denial when a national magazine reported it has purchased several of the cars.

Perhaps the biggest appeal of the Charles Townabout, as it was called, is in its racy appearance, silent and economical and smog-free operation, and apparent ease of maintenance.

The Stinson experiment proved that the utilities and public are interested in an electric car.

The question that remains is: "Does Stinson have enough background to serve as a basis for eventual production of that car?"

The answer lies in current negotiations.

Hopes Abroad

Graves said merger talks continue but indicates they hold less than expected hope of successful culmination. Now he is talking about reorganizing a new corporation with $10 million capital. He and Van Noy are discussing formation of Stinson of Japan with several as yet unnamed Tokyo industrialists.

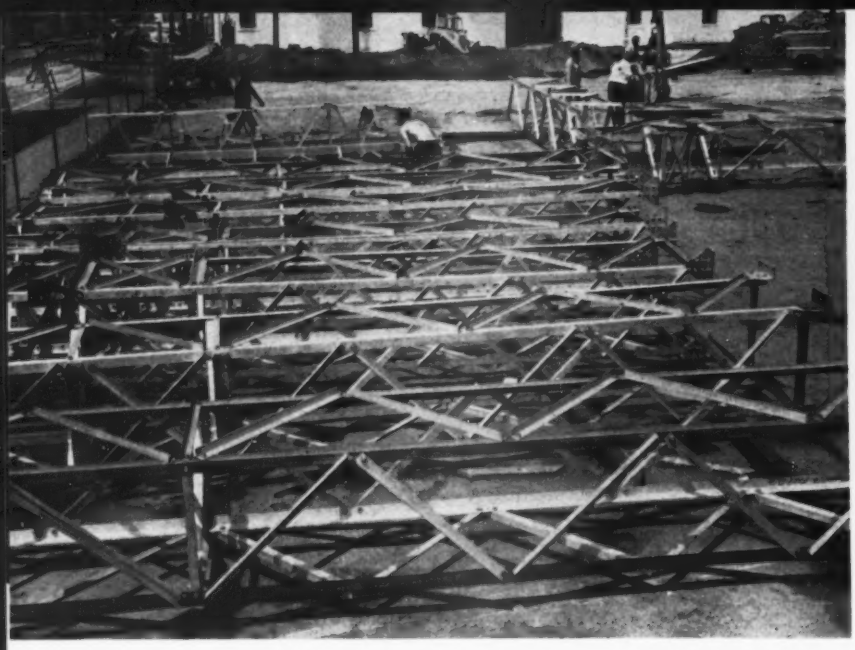
The car—except for batteries and motors—would be built in Japan where the body, for example, would cost $160 compared with $900 here.

His big problem is protecting what Stinson already has developed from the always resourceful Japanese.

Negotiations are also being conducted with West German industrialists but the problem here is the Charles Townabout, an almost exact fiber-glass replica of the Karmann Ghia.

"We'd have to change the body style in Germany," Graves admits.

No matter what, the San Diego production plant is dead. Graves said it may be retained as a research and development facility. That depends on who, if anyone, ends up with Stinson's rights and what know-how the company has compiled. And whether they keep Van Noy and Graves.



Time: 8:15 a.m.—Aluminum towers and trusses for the city of Riverside 34.5-kv substation are shown in the utility's yard prior to erection

Time: 8:20 a.m.—First of eight 23-ft aluminum towers is placed on foundation. Note use of 31-ft telescopic truck hoist right—no special cranes needed

Construction in one day with . . .

Aluminum Substations

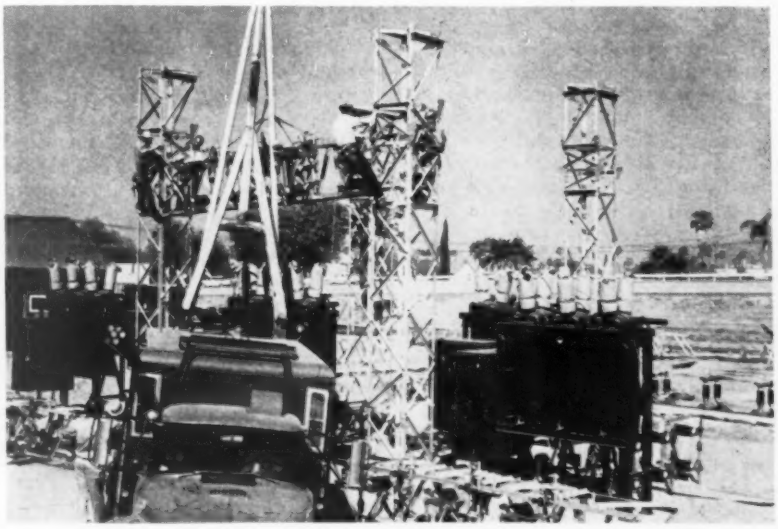
Don Campbell
Utilities Engineer, City of Riverside

An all-aluminum 40-mva, 34.5-kv substation was erected in one shift by a nine-man crew. This performance represents a 40% saving over erection costs for a similar galvanized station.

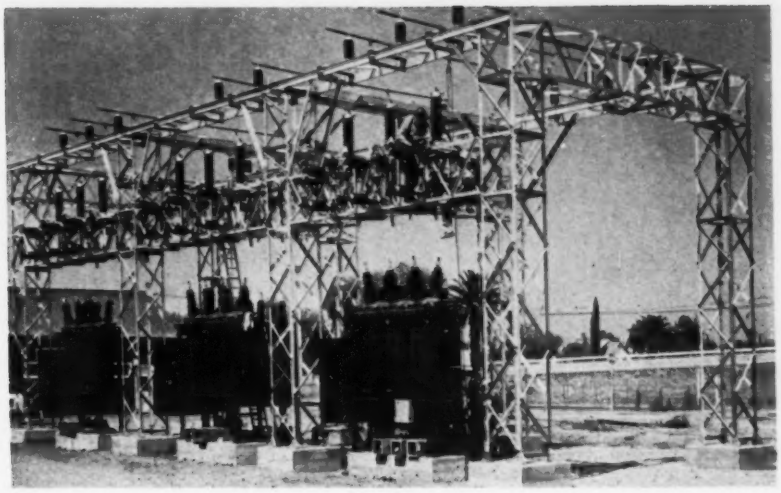
The substation, which consists of eight 23-ft towers and 15 trusses approximately 17½ ft long, is equipped with two triple rated OA/FA/FA transformers — each 12/16/20 mva, 34.5-kv—five 34.5-kv high side circuit breakers and related low-voltage indoor switchgear.

All structural components are 6061-T6 aluminum alloy extrusions supplied by Kaiser Aluminum and Chemical Corp. to Delta Star Electric Division of H. K. Porter Co. Inc., which performed engineering and fabrication in cooperation with the utility's engineering staff.

Standard extruded aluminum angles and channels were used for all structural members. Angles are 2½x2½ in. in thickness of 3/16ths and ¼ in. These were used for both cords and single lacings of the towers. Channels are 6x2.83 in. and 7x3.38 in. in thicknesses of 3/16ths for trusses. Other items included aluminum gussets and footing plates. Columns and trusses were assembled using 2024-T4 aluminum bolts and shipped to the site. Total weight of



Time: 8:55 a.m.—Aluminum truss is hoisted into place above circuit breakers. Trusses are made of extruded aluminum channels and angles. Disconnects mounted on the ground



Time: 2:20 p.m.—Fifth aluminum truss is added as erection nears completion. Minor misfits are easily fixed with ductile aluminum

the aluminum components was approximately 7,000 lb.

Aluminum is one-third the weight of steel and this simplified handling and erection. The heaviest assembly weighed less than 350 lb and pieces were lifted into place by a 31-ft telescopic boom line truck similar to those that are used for setting power poles.

Aluminum's ductility made it easier to cut and modify pieces during erection, a task that usually takes considerable time and effort with galvanized sections. Also aluminum's very good conductivity simplified grounding of the structure.

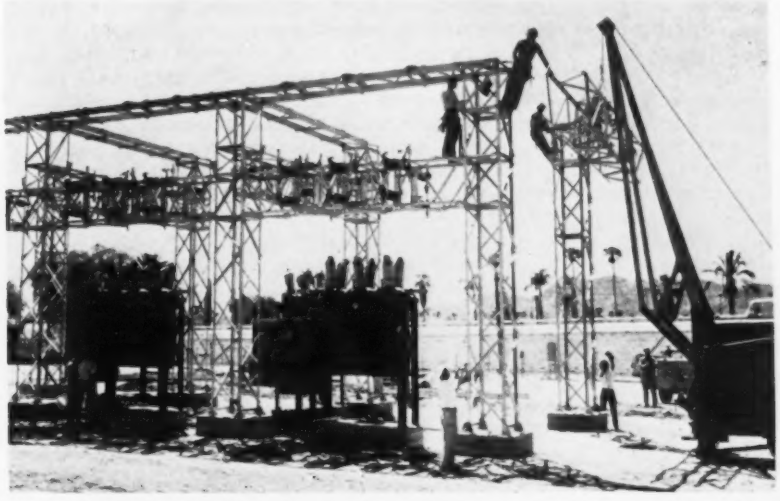
The utility has five other substations in the municipal system with structures of galvanized steel, the traditional metal for this type of construction. In the new substation, however, the city decided to use aluminum since long-range economic values are gained even though the initial cost of the material is higher.

Actual difference in material cost for this substation comparing aluminum to galvanized steel was $1,120. This premium was reduced by lower erection costs and substantial net savings are expected from reduced maintenance costs.

The major economy with the aluminum substation is maintenance. This substation will not require painting since a strong oxide film forms on the surface of the metal and protects it even in corrosive industrial atmospheres.

An additional premium is gained from this maintenance factor since it is unnecessary to shut down the station to paint it.

The net result will be economy despite slightly higher material costs.



Time: 4:45 p.m.—The all-aluminum 34.5-kv substation as erected in eight hours by a crew of nine men. Structural components are 6061-T6 aluminum; bolts 2024-T4 aluminum

UG Cost Comparison

J. D. Oliphant, Chairman
Western Underground Committee

The increasing demand for underground service in residential areas has caused the Western Underground Committee to appoint a subcommittee to create a standard set of underground costing methods. Using the standard approach, U. S. engineers anywhere in California, Arizona, Nevada or Hawaii can compare costs on a comparable basis. The committee has prepared a tentative form which included a check list as well as a cost breakdown sheet. A committee has been appointed and the comments of the group will be incorporated in the final form.

As one member of the committee commented, "Until the industry standardizes on a common method of figuring cost per lot, underground engineers are going to spend more time finding hidden costs than improving present day systems." The biggest problem in finding the real dollars per lot usually springs from private agreements with builders, where such major items as trenching and backfilling are done by the builder and not charged as part of the cost of the underground system.

The Western Underground Committee will urge that electrical industry magazines adopt these standard costing methods (we will), so that progress in various parts of the country can be rapidly brought into popular use.

The Western Underground Committee is an informal association of utility underground engineers from California, Arizona, Nevada and Hawaii. The purpose of the committee is to standardize components that will lead to lower cost systems. At quarterly meetings they compare notes regarding the performance of underground components and discuss new materials and techniques. The individual organizations represented by the Western Underground Committee include: California Electric Power Co., Modesto Irrigation District, Pacific Gas and Electric Co., Southern California Edison Co., Riverside Light & Water Department, Palo Alto Public Utilities, Arizona Public Service Co., Hawaiian Electric Co., San Diego Gas & Electric Co., Los Angeles Department of Water & Power, Burbank Public Service Department, Pasadena Municipal Light & Power, Sacramento Municipal Utility District, Sierra Pacific Power Co., and Glendale Public Service Department.

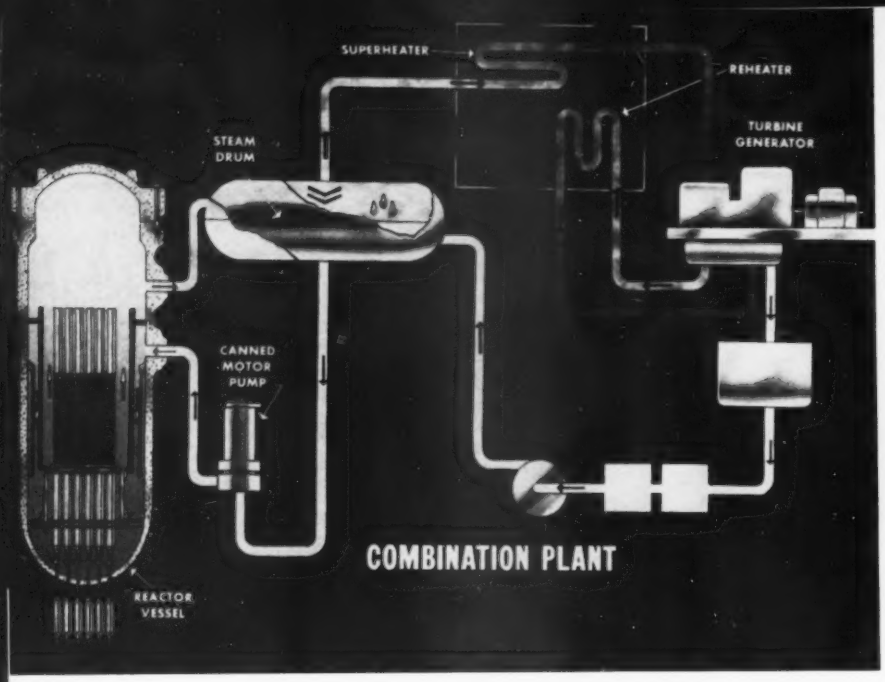


Fig. 1

Current recommendation—225-mw combination plant with reactor and fossil-fired superheater will produce power for 7.3 mills/kwh and guaranteed initial costs of about $220/kw

Westinghouse studies now permit guaranteeing manufacturer's controllable costs: (1) plant capital cost; (2) plant capability; and (3) fuel burn-up for nuclear stations. Result . . .

Atomic Power Costs Crystallized

From recently completed cost analyses by Westinghouse and cooperative work with major architectural and engineering firms, three atomic power plant projects have been identified as logical further steps for utility companies to take in their programs of power generation from the atom. In two of these projects, it is now possible to guarantee plant output, over-all plant costs and fuel life.

This in turn enables utilities to predict with a high degree of accuracy the bus-bar costs of nuclear produced energy. Westinghouse engineers set 7.3 mills/kwh as a present-day reality.

Consider Fig. 2, showing power cost to utilities in mills per kwh as a function of time since 1900. The cost curve for fossil-fueled plants from 1900 to 1959 will approach the band at the left.

Compare this to the band on the right, which, according to the Atomic Energy Commission, represents a prediction of the power cost curve for nuclear plants. All available information indicates that atomic power costs will fall in the range indicated by the right band.

These two curves indicate that utilities must now consider where, when and how much to invest in their nuclear future if they are to continue to produce economical electric power. The answers to these questions will, of course, be related to their individual purpose in entering on a nuclear reactor program. Should the objective be to get a plant on the line as soon as possible, with the best economic picture today's technology can offer; or should one select a more advanced type that has good long-range possibilities?

Westinghouse engineers have attempted to provide utilities with a sound basis for making these decisions by reviewing the current state of the nuclear art and summarizing the current status of the major reactor concepts. (See box on p 82.)

Most actual design and operating experience to date has been obtained with water reactors. There are several varieties of these reactor types but they appear to be the closest to competitive power production.

The first of these is the closed cycle or pressurized water reactor. In this system, water under pressure circulates through a primary loop, picking up heat in the reactor and giving it up in a heat exchanger to a secondary system that generates steam. This system has a wide range of application—from 1 to 400 mw. It is the easiest type to control and the most stable that can be built.

The second major division of the natural water systems is the direct-cycle type, where steam from the reactor is piped directly to the turbine. In one such reactor, called the direct cycle natural circulation system, the incoming water passes through the reactor core forming a steam-water emulsion. Steam-water separation is accomplished inside the reactor; steam goes on to the turbine, is condensed and re-enters the reactor. The difference in density between the steam column in the core and the water column outside is sufficient to cause natural circulation in the steam-water loop. This system has excellent application in the small power ranges from 5 to 50 mw. However, because of water flow characteristics and steam separation problems, it takes a very large core to produce sufficient heat.

To overcome this difficulty, forced circulation of the water has been employed. This brings about higher nuclear efficiency and increases the hydraulic stability of the reactor. Capital costs are increased, of course, but the range of this system is pushed up to about 150 kw. In this size plant, the forced circulation system has excellent prospects.

The combination of the direct cycle and closed cycle system is known as the dual cycle. In one leg of the system, which is operated as a direct cycle loop, steam is carried directly from the top of the reactor to the turbine and then back to the reactor after it condenses. Meanwhile, a second leg is operating on the closed cycle basis with heat from the reactor being transferred first to a heat exchanger that generates steam for the turbine. In the direct cycle end of this system the steam and water are separated outside the reactor; this steam

Fig. 2—Fossil vs nuclear power costs during the 20th Century. Left band—fossil fuel cost will trend upward. Right band—nuclear cost will stay the same or drop as technology improves

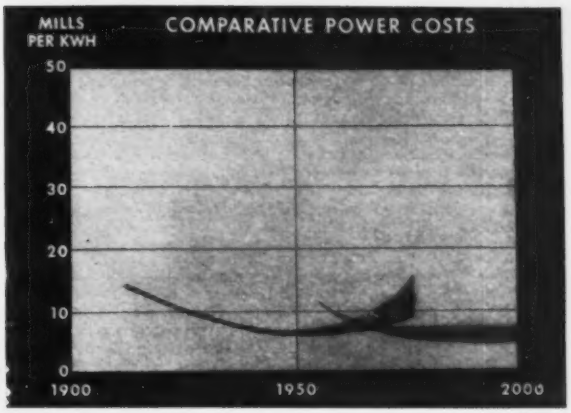


Fig. 2

Fig. 3—Heat rate curves of combination station show marked improvement with superheat-reheat cycle

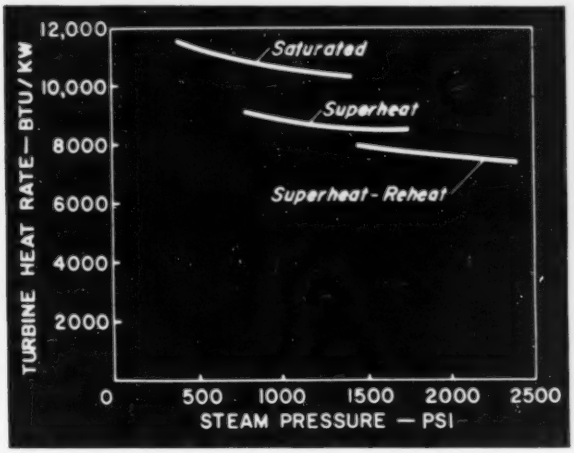


Fig. 3

goes to the high pressure end of the turbine. The lower pressure steam from the closed cycle end enters the turbine in its low pressure range. The power range of the dual cycle plant is from 150 to 300 or 400 mw. This system has higher power density than the other two but also higher capital costs. There's also the problem of possible contamination of the entire primary system including the turbine-generator unit. Since it requires a complicated turbine and control system, this system increases in cost to the point where there is little difference between it and a straight closed cycle plant.

For the larger plants, it is important to determine which of these two systems has the greater present and long-range potential. To establish this comparison a number of parallel technical and economic studies have been made for closed cycle and dual cycle plants up to 300 mw. The power costs for the closed cycle and dual cycle plants are essentially identical over the range of applicability. The saving in heat exchanger capacity for the dual cycle plant is almost offset by the reduction in piping and other components for the closed cycle plant.

Where economics are comparable, the choice clearly goes to the closed cycle system. This is dictated by advantages in the important areas of operation and maintenance.

Use of Superheat

Of all these major reactor types being considered, the water reactors have the greatest promise of achieving competitive nuclear power the soonest. One of the most important variations in design is the idea of superheating steam as it comes from the reactor to bring it up to modern turbine conditions. (See Fig. 3.) Heat rate reductions of 30 to 35% can be obtained by use of high pressure superheat-reheat cycles. Superheating is the next big step and it is a significant part of several specific recommendations made to utilities.

Here is the detailed rundown on three water reactor plants that hold the most immediate promise for the electric utility industry. Detailed over-all designs for two of the plants have been worked out, enabling specific economic and cost information to be presented here.

Combination Plant

The first one is called the combination plant—because it uses both nuclear and fossil fuel. It meets the present need of utilities for an economical way of investing in the nuclear power future. This plant was designed around a modern, presently available turbine and the steam conditions it requires. The nuclear reactor and superheat-reheat system was then designed to meet these conditions.

The turbine, rated at 225 gross mw, can essentially be ordered from catalogs. Steam inlet conditions at the first stage are 1,800 psi at 1,000 F, with reheat temperatures of 1,000°. These steam conditions can be achieved using a direct cycle system.

The next step is superheating to 1,000°. A superheater using nuclear fuel could be designed for this purpose, but this second reactor would have a whole new set of problems to be solved and would be prohibitive economically. The most realistic and available solution is to use a fossil-fired superheater. In addition to superheating steam before it goes to the first stage of the turbine, the superheater is used to reheat steam to 1,000 F, after it passes through the first section, and before it is fed back into the second section of the turbine.

Fig. 1 shows the general operating principle and main components of the combination plant. The vital statistics are as follows: the 34-ft-high reactor vessel is 9¼ ft in inside diameter, and its walls are of 8-in.-thick carbon steel with a quarter-inch stainless steel lining. The core of the reactor is fueled with about 26½ tons of uranium fabricated into small pellets. This uranium is enriched to about 2%.

The superheater with its auxiliary equipment stands 146 ft high and is 76x65 ft in rectangular dimensions. This superheater can be fueled with either oil, gas or coal – the choice depending on individual utility economics.

The nuclear portion of the plant contributes about 300 mw (thermal) and the superheater about 220 mw (thermal) to the net power output of the plant. Together, they would produce an electric gross output of 225 mw. The total heat rate of this plant would be the best yet obtained from a nuclear plant—9,040 Btu per kwh, net.

Work toward construction of this plant can be started immediately and it could be in operation four years

Summary of Reactor Concepts

• The most exotic idea and the one, therefore, that seems furthest in the future is that of power from thermonuclear fusion. There are many technical problems to the fusion approach. However, the potential of fusion reactors indicates that the human race, with its need for power, simply cannot afford not to continue to investigate them. Great sums are being spent for research and development, but there is no conclusive evidence as yet that the present investigations will lead to immediate solutions of the technical problems.

• Among the fission reactor systems the thermoelectric reactor system, in which heat from fission is converted directly to electricity without the use of a conventional steam cycle turbine-generator, is intriguing. At present, however, the conversion efficiency of available materials is the limiting factor in application of this principle. Recent research shows that the new mixed-valence compounds have the best efficiency for electric current generation. This type is not visualized as large central station thermoelectric units, but should have application in satellites, missiles or small remote stations.

• Breeder reactors, prototypes of one such type (the fast-breeder type) have been built and operated, and a 100,000-kw plant of this type is under construction. Operation of this plant will be the means by which it will be possible to assess the long-range potential of this reactor type.

• Another version of the breeder principle is the thermal breeder reactor, using either a solution or a slurry mixture that contains the fuel. The solution type, being developed by the Oak Ridge National Laboratories, uses a uranyl sulfate-acid solution. In the slurry type, a thorium oxide slurry circulates through a loop and fissions in a reactor section. From current studies on this design, participants agreed that construction of a prototype would be necessary before a decision could be made to proceed with a full-scale plant.

The gas-cooled reactor can either be direct cycle or closed cycle. In the former, the hot gas (1,300 F) from the reactor is sent directly to a gas turbine. About five to six years will be needed to bring this concept to a practical design, technical difficulties with the high temperatures encountered in the reactor being a principal stumbling block.

In the other closed cycle system, the hot gas from the reactor is passed through a heat exchanger to produce steam (the British Calder Hall reactor). It has the disadvantage of requiring very large heat exchangers because of the poor heat transfer characteristics of gases. This, of course, adds weight and capital costs. Enriched fuel systems (instead of natural uranium) and the consequent high operating temperatures for this concept are being investigated, however, by the High Temperature Development Corp.

• Organic reactors are subdivided into the fixed and mobile fuel types. In the former, the coolant-moderator flows through the reactor and gives up its heat to a secondary system through a heat exchanger. The coolant and moderator is oil or phenyl compound and, using it, the primary loop can be operated at much lower pressures for equivalent temperatures as compared to water, and oil is much less corrosive, allowing the use of relatively thin ordinary carbon steel instead of stainless.

Offsetting this highly desirable cost advantage is the fact that even the best oils have poor heat transfer characteristics as compared to water; and oil decomposes under reactor conditions and has to be purified and replenished. This can add between a half and one mill per kwh to the cost of the operation.

Definite promise for superior economics is the mobile or fluidized bed system wherein the fuel is in the form of spherical capsules in the reactor vessel. The coolant-moderator flows through the vessel and distributes the pellets evenly throughout the vessel. The coolant goes on to a heat exchanger and then back into the reactor vessel. Although having the oil disadvantages mentioned above, this type has distinct advantages since it provides uniform distribution of fuel and burn-up; and the fuel is easily removed or renewed. It looks promising for the smaller plants of 5 to 100 mw but, to perfect it, money is needed for research and development and for the construction of a prototype.

• Reactors using heavy water as coolant and moderator have the advantages of using natural uranium as fuel and the excellent moderating properties of heavy water. However, heavy water is expensive—currently about $30 a pound—requiring extra precautions to guard against loss of heavy water.

The economics of this reactor type appear good in the 200-mw size using natural uranium as fuel. Once a prototype, now under construction, is in operation it will be easier to determine if the over-all advantages of the concept offset the disadvantage of the high cost of heavy water.

---

from the date of the contract. Feasibility studies indicate solutions to the major technical problems presented by this plant type.

7.3 Mills/Kwh

Now to economics. As a set of ground rules, the figures are based on 90% load factor; 12.5% annual charges; fossil fuel costs of 30¢ per million Btu; and plutonium credit of $12 per gram, and 0.5 mill for indirect costs.

Under these conditions, the direct cycle nuclear power plant with fossil-fired superheat and reheat will produce electric power for 7.3 mills per kwh. These costs break down as follows: 3.4 mills in capital investment; 2.7 mills for fuel; 0.5 mill for indirect costs; and 0.7 mill for operation and maintenance. The 2.7-mill fuel figure is based on current costs and using 30¢ per million Btu oil in the superheater, which is good average. Coal might cost less in itself but the attendant capital investment in rails, storage, ash disposal, etc., would bring the actual cost to about the same figure.

It is important to note that fossil fuel costs affect the total power cost estimates of the combination plant. Naturally, as fossil fuel costs rise, the economical advantage of this plant over totally fossil-fired plants will become less distinct.

Today, the all-fossil-fueled power plant holds the economy edge over the nuclear plant in all but the highest fuel cost areas of the country. How long it will be until the nuclear plant supplies the least costly power in every area depends on local conditions. In some areas the combination plant will win out on a mills-per-kwh basis *over the lifetime of the plant*. Therefore, until the time when the all-nuclear plant supplies the least costly source of power in every area, there is definitely a place for the combination plant – part nuclear and part fossil fueled.

The 225-mw combination plant can be built essentially from today's technical know-how. There are no major research and development hurdles. This is reflected in the R&D cost, which is estimated at $4.5 million. The plant itself will cost $45 million—approximately $220/kw.

Integral Boiling and Superheat Reactor

The fundamental superheat concept, namely, obtaining more power from each pound of steam, is responsible for the combination plant and leads to the second recommendation to utilities—the all-nuclear plant with integral superheating. In this plant, called the integral boiling and superheating reactor, the water is both boiled and then superheated within the reactor core. No separate unit for superheating is required. This plant is further in the future than the combination

plant; we envision a full-scale plant of this type to be operating in 1975—if the proper steps are taken now.

The integral boiling and superheating reactor, although a long step into the future, is ultimately a very economical, very efficient 200-mw reactor. A thorough research and development program coupled with construction of a prototype plant must precede the full-scale 200-mw plant.

330-Mw Closed Cycle Plant

Discussion about the long-range all-nuclear plant does not mean that a large, economical *all-nuclear* plant cannot be built for utilities today.

At present, Westinghouse can recommend the construction of a 330-mw closed cycle, water moderated plant. The philosophy behind this plant is based on the facts that (1) there is economy in large reactors and (2) the closed cycle plant is the most proved type to date.

This recommendation is the result of a detailed study to establish feasibility and economics of closed cycle plants up to 400 mw, with plant start-up to be early 1965. All these plants were established as being feasible within this time scale. The economics of the larger ratings looked particularly promising. So promising, in fact, that a comparison was developed with conventional plant costs in the medium-to-high fuel cost areas of the United States. This comparison is shown in Fig. 4. The cost band for conventional plants reflects a fuel cost range of 27 to 45¢ per million Btu at plant start-up date. The curves are based on a conventional fuel cost rise of 2½% per year, which checks closely with the Edison Electric Institute prediction. Nuclear fuel costs were maintained constant based on the conservative expectation that advances from present intensive fuel cycle development programs and increased production will offset future inflationary effects.

The closed cycle system discussed earlier uses both a primary and a secondary loop. The primary loop circulates pressurized water through the reactor and a heat exchanger. Here the heat is transferred to a secondary loop, producing steam which is piped to the turbine. The condenser and other secondary equipment are all conventional designs.

As to physical size of this 330-mw unit, the reactor vessel itself weighs 300 tons, stands 41 ft high and is a little less than 12 ft in inside diameter. Its walls are carbon steel about 10 in. thick, with an inner cladding of 1¼ in. of stainless steel. The reactor will be contained in a sphere with an over-all diameter of 140 ft and walls 1¼ in. thick.

The fuel is in the form of uranium oxide pellets clad in either stainless steel or Zircaloy 2. For more uniform heating and better fuel economy, a novel method of loading the core in three levels of enrichment has been developed. Looking down on the top of the reactor, visualize three concentric circles into which the fuel elements are loaded. In the inner circle, the fuel enrichment will be about 2.1%; in the intermediate, 2.6%; and in the outer circle, 2.9%.

Fuel life for this reactor is three full-power cycles. After each cycle the center circle of fuel is removed. Then the second and third layers of fuel are moved toward the center and a new outer layer of 2.9% enrichment added.

The uniform heat rate that will result this way will allow the use of fewer control rods, less expensive fuel and more kilowatts from a given fuel load—all of which mean definite economy.

After the primary loop water passes through the reactor, it flows to one of the five steam generators. The flow of water through the reactor is 75 million lb per hour. Each steam generator is 45 ft high and just less than 10 ft in inside diameter. The heat exchange tubes within will stand in a plate 23 in. thick and almost 10 ft wide. No plates of these dimension have ever been produced but feasibility studies indicate that it can be done.

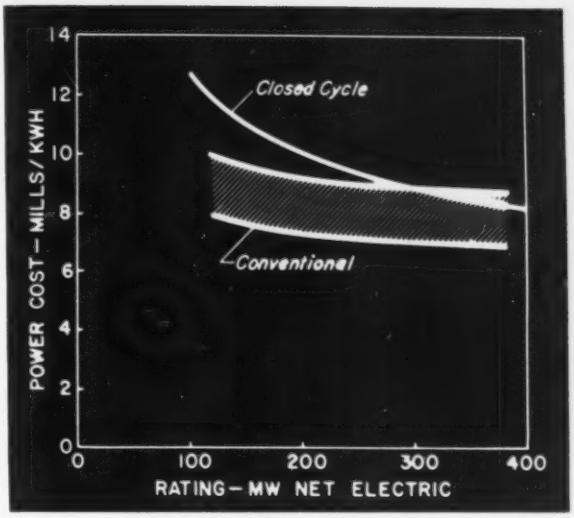


Fig. 4—In large sizes, closed-cycle reactor design tops high-cost fossil-fired areas in power cost

In each of the steam generators, approximately 900,000 lb per hour of dry and saturated steam are produced. All five funnel through a common header into the secondary loop, which feeds steam to the turbine at a rate of nearly 4½ million lb per hour.

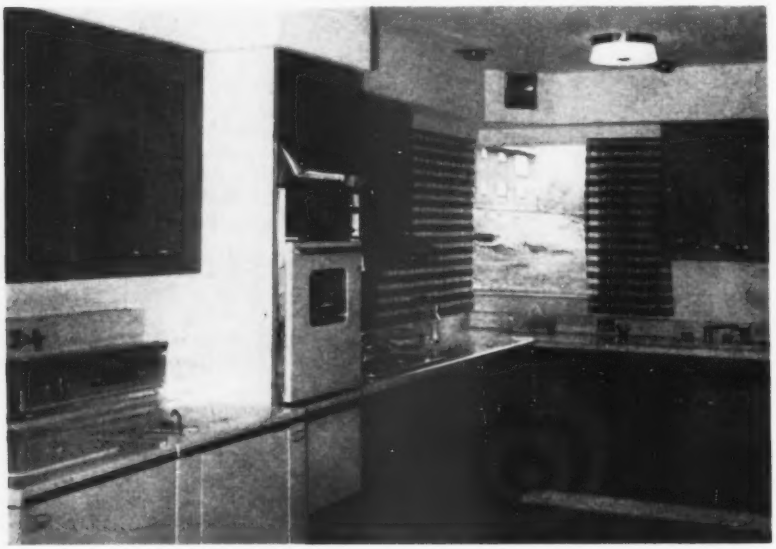
Feasibility studies of a closed cycle plant at every rating from 5 to 400 mw show that power costs reduce sharply in the closed cycle plant until 330 mw is reached, and then there is a sharp leveling in the curve. At that point, the largest single-shaft, 1,800-rpm turbine is being used and beyond this point parallel turbines are necessary. Operating on a single shaft with 40-in. exhaust blades, the complete turbine-generator set will be 135 ft long.

This plant is the first all-nuclear power plant to produce electric power on a reasonably competitive mills-per-kwh basis. Here are the figures, using the same ground rules quoted before: for capital expenditure—3.3 mills per kwh; fuel—3 mills per kwh; operation and maintenance—0.5 mill per kwh. Including indirect costs of 0.5 mill/kwh, the total cost per kwh—7.3 mills. This makes it today's most advanced all-nuclear power plant with good short and long range economics.

Again, because of its proved design, a relatively low research and development cost of $4.4 million is required. The plant itself will cost $68 million which, in this high rating, breaks down to the low capital investment per kilowatt of about $220.

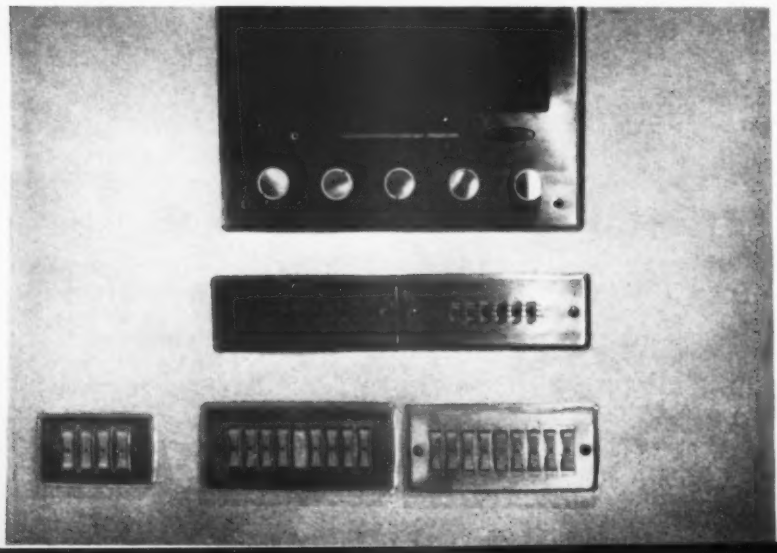
Estimates of costs for each of plants include all probable expenditures for components and building materials. Naturally, such items as taxes, interest during construction, land, offsite improvements, escallation and general administrative and overhead charges are not included, since they could not be estimated accurately without reference to a specific contract. However, this has been estimated as 0.5 mill per kwh.

Garden lights and units under eaves at all corners of Irving Thompson home are controllable from many points or automatically



Copper trim on kitchen lighting and appliances gives warmth to this attractive area

Central sound and electric control in the kitchen, using low-voltage relay system

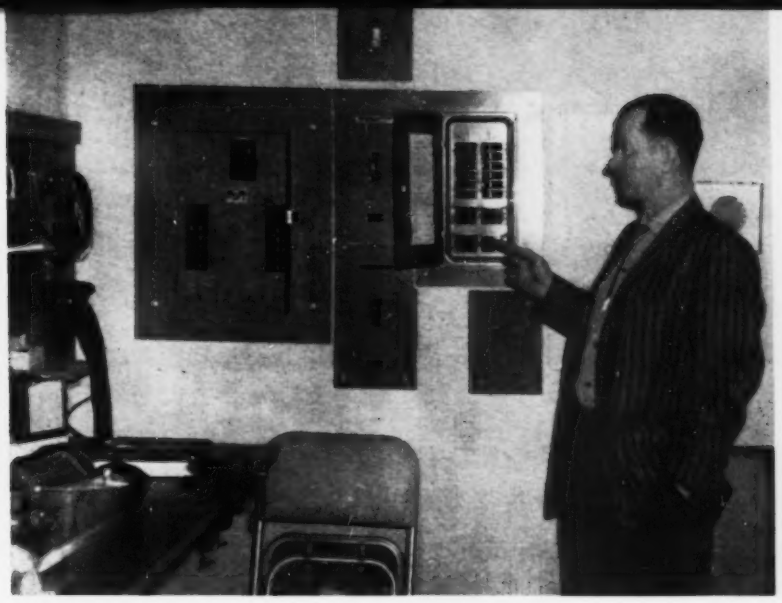


Control

Firm in the belief from long experience in electrical contracting and industrial jobs that control is the greatest benefit that electricity can provide, Irving Thompson, Thompson Electric Co., Salt Lake City, in designing the dream home that he and Mrs. Thompson had long wanted to build, made electric control the very nerve system of it. Not only is theirs a Gold Medallion, electrically (with heating cable) heated, fully appliance-equipped home, it provides the most complete system of control for all of it – lighting, sound, intercommunication, even heating and water softening – to be found in the West.

Although the Thompsons had no intention to use their home as a demonstration one for selling purposes, it has proved very effective as such just from word-of-mouth telling of its attributes by neighbors and friends. It is not a large home, 1,860 sq ft on the main floor (4,000 in all), but considering the usefulness and convenience, not to mention comfort, provided by its electrical system this is not considered out of proportion by the Thompsons. More people should know and enjoy such service. The cost, approximately $5,000 to duplicate for a customer, including all appliances and wiring, is less than the car most people put in the garage and expect to replace every few years.

The variety of control is provided



Main service breakers, heating and lighting panels near Thompson's garage workbench

Hallway aisle lights combine plug outlets

Does It

by ingenious application of Remcon low-voltage relays that contain their own transformers. With these not only is the lighting controlled from every convenient point imaginable but also the heating, music, intercom system, fans, auxiliary bathroom ceiling heaters, garage door and certain appliances. The master location is in the kitchen with submasters in the master bedroom and garage, as well as front entrance. Time switches are used extensively —for water softener cycles, for outdoor garden lighting and automatic sprinkling, for programming music or radio, etc.

Interestingly, Thompson brings three 100-amp feeder circuits underground in separate 2½-in. conduits from the meter at the power company pole along the rear property line. Each is terminated at a breaker in the rear of the garage. Two feed 24-circuit lighting panels, one upstairs, one downstairs. A third goes to the power panel for heating, air conditioning, outside lighting and freezer. There is a total of 62 single-pole circuits and 10 double pole.

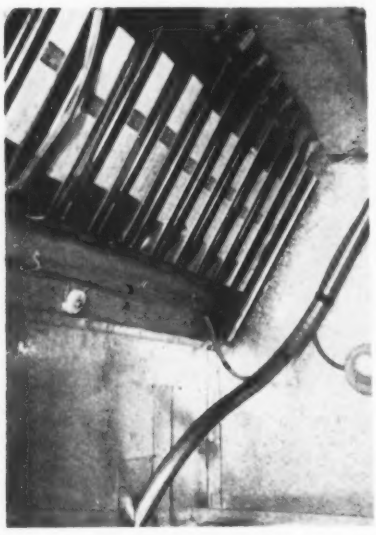
Telephone jacks are located in every room including garage and patio porch; intercom in all rooms including baths. Seven 12-in. speakers are mounted in ceilings for radio or phonograph music. There is even a dumb-waiter between floors and a portable hot cart for outdoor food service.

Valance and eyeball floods for wall light in living room and adjacent dining room

Recreation room has a variety of lighting combinations available; also sound

Lettering is silhouetted in sharp contrast against luminous background of the building

White painted light boxes for each tube make the light source behind the panels



Ballasts are mounted remotely in a metal lined, vented room inside the building

Bellingham contractor pioneers high output

Luminous Sign Front

Certainly the brightest place in Bellingham, Wash., is the Howard E. Mills, electrical contractor, building, thanks to that company's bright idea to pioneer a new luminous front and sign method by using it first themselves. It has proved a good sales demonstration and several other similar sign and building fronts have been installed or are to be as a result of it, Bill Zelloski of the company reports. (One such is shown in construction in the middle picture. It is for an adjacent building.)

When Mills Electric and Haskell Corp., a plumbing contractor, had a new building built at 1511 Cornwall St., Mills decided to make it an advertisement for a luminous front. Light boxes were made for each 96-in. high-output fluorescent tube by means of 2x8-in. boards fastened vertically. A socket was mounted at each end, the conductors for which were run back to a closet inside the building, back of the sign. In this closet, metal lined for fireproofing and equipped with a blower for ventilation, all of the ballasts were mounted. There were 34 89G768 and 36 89G756 ballasts for the entire front. A 14-circuit breaker panel (six spares) was also mounted there. Time switch and relays and a 24-v transformer for the relays handle the automatic switching of the sign. Interlocked is a fire detection system that would cut off current in event of fire or overheating.

A metal gutter the full length of the sign front carries the lamp circuit wires, with a common bare neutral ground back to the cabinet.

The luminous panels are of acrylic in which the sign is cast in black and color. To support the panels, steel channel was mounted on the outside edge of the 2x8 boards, which are spaced 12½ in. on centers.

The entire street is better lighted from the sign than from the street luminaires. By day the attractive contrasting white plastic panels and lettering are equally visible to the entire neighborhood.

ELECTRICAL WEST
Construction News

For
-contractors
-consulting engineers
-lighting engineers
-wiring designers
-distributor salesmen
-all interested

Norman Ferguson, California Electric Works, San Diego, was unanimously approved for nomination to be the next District 9 NECA vice-president at the meeting of the District 9 council in San Mateo, Sept. 11 and 12. J. D. O'Connor, Sacramento, who has held the post twice, declined to run again. Ferguson has been governor of the San Diego Chapter and a past president of it.

Changes in prospect

Support indicated for the legislative and governmental affairs program for the California chapters of NECA may bring some changes in the northern California area. Following a complete report on the last legislature and other governmental affairs affecting contracting by Ernest Kramm, Northern California Chapter manager, representing the NECA chapters, an effort will be made to finance a full-time legislative advocate, presumably Kramm. This could mean a change of managers in the Northern California Chapter. The program has to be ratified by the individual chapters by Oct. 15, and becomes effective next year.

New manager at San Mateo

San Mateo Chapter held a special meeting Sept. 14 to introduce Robert Coleman as its new manager on a full-time basis. Everett Marshall, Marshall Electric Co., chapter president, and William J. Varley, who has been manager of that chapter as well as the San Francisco one in the past, made the announcement. Varley will continue in an advisory capacity.

Coleman has recently been assistant manager to George Harter of the Santa Clara-San Benito Chapter and has worked principally in the Santa Barbara region. Before that he, at one time, managed an independent contractors association in Santa Clara, has worked as a manufacturers' agent and an estimator. Coleman promised to develop a strong program for the chapter, which was only a year old in September.

Bob Coleman's resignation caused the Santa Clara-San Benito Chapter to look for a new assistant chapter manager. Someone living in or near the Santa Barbara area was being sought. That chapter likewise was planning to establish with the union an industry coordinator to handle the joint apprenticeship committee and to work with architects, engineers and owners and on codes and standards.

Even San Francisco may have a change as the association granted William J. Varley a furlough to become coordinator for the joint industry board of the San Francisco area. . . . From San Diego comes word that E. Sabo has resigned as manager of the San Diego Chapter. No successor had been named at press time.

Strike in Maui

Hawaiian Islands have been stirred up since statehood as Akito Fujikawa, business manager of IBEW Local 1186, called a strike in Maui to organize the union there and to get an increase in wages. A three-year offer was made by the IBEW to go from the preceding average wage of $1.74 an hour to $1.87 on Aug. 15 increasing on a graduated scale each year to $3.98 after March 15, 1962. The affair affected 11 electricians and three contracting firms who signed the new agreement.

The county supervisors refused Fujikawa's request to make some electrical workers journeymen without written examination. . . . In Honolulu, on the other hand, Alvin Shim, of the same union, requested the ordinance be amended to exclude helpers from being allowed to assist journeymen electricians, claiming only apprentices at higher scales could do the work. Action was postponed.

Awards for Los Angeles

An award for "outstanding labor relations during 1959" was presented the Los Angeles Chapter of the National Electrical Contractors Assn. and Local 11 of IBEW by the Catholic Labor Institute. The 13th annual Coogan Award was presented to Ray Carey, executive vice-president of NECA, and George O'Brien, IBEW business manager. Ironically the same union staged slowdowns recently to gain higher wage increase agreed to by the chapter.

In Everett, Wash., the three issues submitted in August to the Council on Industrial Relations were settled favorably. One of the issues was a shift work clause and it was granted, likewise another on free zone limits on time and another on a contractor's option to pay travel expense or per diem.

Puget Sound training courses

Several training courses are about to start in the Puget Sound Chapter. A sales training course started Sept. 15 with 32 signed up from local contractors, the course runs 11 consecutive Tuesday evenings in the lounge of the AGC building for members only. In Everett, the Cascade Division started an estimating course on Sept. 21 at Everett Junior College. Jules McClean, chief engineer, Snohomish PUD, is the instructor. Contractors from Bellingham have also enrolled in the course.

Deaths were reported among well-known electrical people . . . . Joseph Walta, vice-president of Littlejohn-Reuland Corp., Los Angeles, secretary-treasurer of NISA Los Angeles Chapter and prominent in the EMEA, died July 25. . . . Walter E. Coburn, a co-founder of the EMEA of Southern California and its first president in 1936 and 1937, died of a heart attack in Phoenix June 5. . . . Robert W. McChesney, former president of NECA in 1939-49, died Sept. 10 in Washington. He had made several trips to the West and was well known here.

New legislation

Passage of the labor bill by Congress may have brought forth a chorus of protests from union officials but the new legislation does permit the building trades unions to sign agreements requiring contractors to hire only union workmen, or join the union within seven days, and to deal exclusively with contractors who do so. This has long been sought by electrical workers and contractor associations.

Bid shopping and peddling received a set back in Illinois when the legislature amended its "Purchasing Act of 1957" so that segregated bidding and contracts are now required on state work or plumbing, heating, ventilating and electrical work.

Copper prices have reflected upwards the strikes in the copper industry. The national steel strike likewise was beginning to affect construction. Neither strike being very close to settlement at press time.

Electrical Inspectors Assn. of B.C. offers prizes of $100 for the best paper, brief or thesis on any part of Sections 4, 6 or 8 of the Canadian Electric Code Part 1. What is sought is a new approach to a "problem, new interpretation or new rules." The contest closes Dec. 30, and awards will be made at the 1960 convention.

Motors and Controls—VI

Methods of Starting Motors

Tom Hughes, Electrical Safety Engineer, California Division of Industrial Safety

The expansion, brought on by the first World War, gave a real impetus to the generation of a-c and its transmission over relatively long distances. And with it came this clever new "induction motor." The wonderful thing about both the transformers and the motors (that went with a-c electricity) was that they had their own built-in governor.

Machinists or millwrights of this generation seldom hear of a governor but the workers of those days had always to worry about belts breaking or malfunctioning of governors and the prime movers overspeeding. And here was a new motor that was built around a certain speed. It didn't require an attendant because it couldn't possibly run away.

Not only did it have an established speed for all conditions but it regulated its intake from the line as its load varied and thus fairly well maintained its normal running speed. And the key to this amazing self-governing faculty was a force called counter electromotive force (back emf), an inherent feature of both transformers and induction motors.

In each of these a-c machines the back emf accomplishes its function by opposing the supply voltage of the line (the applied emf) and thus limiting the amount of current drawn. Actually the back emf is a reflected or fed-back effect. In other words, the current flowing in the rotor or secondary winding induces a proportionate force in the primary (which bucks the fed-in supply). The difference—transformer versus motor—is that we get a direct magnetic interchange between primary and secondary windings of the transformer while, in the motor, the interchange is limited by the air gap.

So, the back emf in the motor stator winding is produced mainly by generator action. This means that there is practically no back emf to buck the line current until the rotor starts turning and approaches running speed. Then our governor goes to work. At no load the rotor accelerates to a certain degree of slip, depending on the coil disposition of the stator and comparable number of slots in the rotor. With application of load, the slip or lag increases with consequent reduction of the generated back emf in the stator. Less back emf allows more line current to be consumed and the rotor picks up speed to approach its original no-load slip again.

This chain of events is a natural sequence in a general-purpose motor. In other words, it has ideal governor action: will maintain a close range of running speeds unless it is grossly overloaded or the line voltage drops. But the description of this governor action is not so simple when we get into high resistance rotor windings and wound-rotor class.

There is a complexity of factors involved and it doesn't seem to make sense that adding resistance to the flow of current in the rotor winding produces concurrently: greater torque; less current inrush (better voltage regulation) from the supply line; and higher power factor (less transient disturbance in the line with load changes). However, as might be expected, back emf cannot be counted on for self-governing when resistance or reactance are in charge of rotor action. Nor can back emf be counted on to regulate the speed with reduced-voltage (autotransformer compensator) starting.

Thus these two older methods of starting are controlled manually by an attendant; in sequence by external timed switching; or automatically by some form of built-in mechanical governor. Circumstances today have practically ruled out all these methods of starting and control but we users of motors are just about as stuck in the mud, when it comes to modern applications, as the householders who are trying to use the higher current-consuming appliances in their old houses. So let's take a better look at the direction of change and the results.

Forty years ago, motors were large in frame size and slow speed. They sat on a foundation; on the floor; or on their own platform in the structure, for driving a line shaft. Their controls were made in large cast iron cases and took up a lot of room. Floor space was cheap and wages for attendants almost as cheap. But the advent of remote control (push-button start and stop) and self-contained power for each machine or load has changed all this.

The first competition from the cross-the-line start motors and demands for remote control brought complicated automatic compensator-start setups for the older (existing) motors; but this was misspent money in the average case. One of the reasons for remote control of motors was the need for more frequent starting and stopping and we tried to show (at the first of this series) that these large old motors were mechanically wrong for such applications.

So let's face it: the large, slow speed, built in governor; or externally variable resistance start; or copper bar squirrel cage reduced-voltage start motors are only suitable for smooth running, continuous duty loads where floor space is not at a premium. But that brings us to the disgustingly confused state of affairs today.

Even as the advertisers are telling the consumers that you just take the modern air conditioners or clothes dryers home and plug them in to your appliance circuits, the motor manufacturers of the twenties told the motor users that you just throw these new motors across the line and they take care of themselves. And we electricians and plant engineers were so busy digesting the flood of new "industrial control" systems that we gave these new ball-bearing, self-contained motors a good letting alone till we learned that they could rebel, if not properly applied.

In the days of the first World War, we old-timers could walk by a motor and its controls and tell you what the setup was without even looking at the name plate. Today, the same exterior case can enclose any one of a hundred different types and styles and even examination of the greater amount of information they put on the name plate today doesn't tell the whole story. One has to check style numbers against catalog instructions and specifications to know what the correct application is.

President George Taylor presents cup for first award in national MMILJ contest to San Francisco's John Epperson and Lloyd Dehrer

IES Treks West for National

It was a good show – a big show! Let's review it as such. That's the best we can do considering time and space. Seldom is so much light on so many subjects crowded into so few days.

As a show, the big 1959 National Technical Conference of the Illuminating Engineering Society in San Francisco, Sept. 7-11, provided all the elements of drama – conflict, complexity, as well as color, light and sound. For the first time in 10 years (20 years to San Francisco when the last IES convention was held there) it brought to the West the high priests of the various ideologies of light. It brought performers on the platforms of three parallel series of sessions from all parts of the U. S., Canada, even England and France. It brought a registration of some 950 men and women to listen to them, look at their charts, pictures, new devices and fixtures. It provided a rare chance to see and appraise people whose names have been revered in the profession.

As the electrician seated among those in the gallery follows with a spotlight the characters on the stage, let this be a Western spot to pick out some of the more significant attributes of this three-ring intellectual circus. (Complete technical papers and the discussions of them will appear later in *Illuminating Engineering*, the Society's transactions.)

Like a prologue, the opening business session Monday morning of Labor Day began with Charles L. Amick, Day-Brite, St. Louis, national conference chairman, calling on the national officers for their reports. An exceptionally gracious and at-ease President George J. Taylor, Day-Brite Lighting Inc., New York, made his presidential report like a personal conversation with every member. The informality and friendliness of it carried over unexpectedly past the reports. Taylor asked for questions or comments. A surprising number arose to ask about a variety of association affairs, initiating a new rapport between officers and members.

President Taylor made vivid the

Conference Chairmen John S. Walsh and Charles L. Amick, local and national

President-elect Joe B. Browder, Georgia

need for training more illuminating engineers and for continued research. As the public accepts the results of research by Dr. Blackwell (Ohio State) and Professor Dan Finch (UC), the need for qualified engineers to provide the seeing conditions the eyes require will increase. Within five years some 3,000 lighting men will be needed, he said.

One excellent means for creating interest among students is the annual college Allied Arts contests, James R. Chambers, Appleton Electric Co., IES general secretary, added in his report to reinforce Taylor's words.

With a personal platform to "Take IES to the Public" President-elect Joe B. Browder, Georgia Power Co., gave praise to the 700 or more members working on national committees. But because so little of this work is known to the public he felt that means must be found to acquaint it with the works of IES.

Eight men were honored by elevation to the rank of Fellow (none from the West this year), and the presentation of the Gold Medal Award to Dr. N. A. Halbertsma of The Netherlands was made in absentia as more of the preliminaries. Among the new officers elected were J. S. Hammel, consulting engineer, Glendale, as a director to succeed J. D. Whitnell, Arizona Public Service Co., Phoenix; and Lloyd S. Reed, manufacturers' representative, Denver, as Intermountain Region vice-president to succeed Eugene Fleming, General Electric Supply Co.

Prior to the show of the year, the Report of Progress in lighting during the past year, staged at the first night's spectacle, an out-of-door "Son et Lumiere" contribution to the convention was made by San Francisco's own creative artists. Under the design and direction of James Jewell of Holzmueller Corp., theatrical lighting specialists, and with the cooperation of the dean and canon theologian of Grace Cathedral, the first major public showing in America of this art form combining sound and light with narration was given especially for the IES. (See p 128)

In "A Trek to the West" (evidently in a replica cable car with John S. Walsh, conference executive committee chairman, at the grips) E. A. Linsday, G-E Co., Cleveland, dressed like a gay '90s patent medicine spieler, and with the aid of slides, pictures, lamps and gimmicks and a revolving stage made by Robert Tipton, San Francisco coordinator for the Progress Report, paraded the year's lighting achievements. For two hours there passed before the crowded ballroom audience the outstanding lighting applications, the new light sources, the new fixtures and controls, the new materials and designs. These covered every field of application—residential, commercial, industrial, school, public building, street, highway, airport, ad infinitum. Whenever the technical became too heavy a bright change of decor was provided by twin beauty queens from Palo Alto, whose presence may have given some a double vision.

After such visual evidence of lighting progress came, appropriately, the dissecting sessions, the brain mining

As Domina Spencer (left) explained, "Dr. Blackwell and I are closer than you would think, but both of us like to argue."

Robert Tipton, Progress Committee coordinator shows the new iodine cycle lamp

Computer lighting calculators from California: Prof. Philip F. O'Brien, UCLA, Bill Jones, Smoot-Holman, and Roy Jones, Westinghouse, examine a proposed graphic chart aid

Christmas decorative ideas displayed at residential forum by W. D. Jones, Cleveland

My Most Interesting Lighting Job contestants, South Pacific Region, IES: left, Residential—R. L. Sawyier, who won first in region, fourth in national contest; Helen Eldridge, San Diego, third; W. J. Locklin, Redlands, who won second in the regional.

Right, Commercial-Industrial MMILJ contestants in Sept. 6 South Pacific Region, finals; Jack Adams, San Bernardino; Mel Paul, Compton; R. J. Huff, San Diego, third; Lloyd Dehrer and John Epperson, first, San Francisco; Earl Storrs, Stockton, second

and assaying. In five mornings and afternoons, sometimes three sessions running simultaneously, the intellectual drama was played. Carefully prepared and screened technical papers were presented by their authors, experts in their own fields at half-hour intervals. Then they were thrown to the mercy of their competitor critics for discussion. All of this was as gentlemanly as a formal fencing match. Each discusser began with "The authors are to be commended on their excellent paper" before they added "but we question —"

The value of this procedure, even though amusing at times, is that subjected to such scrutiny theories receive an acid test. No one seems overawed by the expert to the extent of accepting his pronouncement without question. Even those whose theory and terminology are beyond the altitude of most members are challenged by those flying in the same stratosphere.

Such supersonic encounters enlivened several deeply technical sessions in which Dr. Domina Spencer of University of Connecticut, the good looking goddess of Greek nomenclature appeared. Apparently dominated by a compulsion to prove male brains inferior to woman's, either in her paper or in discussion of Dr. Blackwell's empirical rather than mathematical testing methods, she tossed a few Jovian thunderbolts. To these challenges other scientists abandoned chivalry and launched a few rockets toward Olympus themselves. Here was drama on an exceedingly high lumen plane, relished by the mere practitioners of footcandles.

The range of subjects dissected and diagnosed included photometry, calculations, light sources of all types, research, applications of light sources, of research, roadway lighting, residential lighting. In all, about 40 papers were presented, half of them devoted to light sources and applications.

Western participants in these presentations included Prof. Philip O'Brien of University of California at Los Angeles and Bill F. Jones of Smoot-Holman Co., Inglewood, both of whom described the use of computers for the calculations of lighting — O'Brien of computing room lighting performance; Jones of predicting fixture design performance. Roy Jones, Westinghouse, Los Angeles, participated in the discussion.

Most practical and universal in appeal was the final runoff of the "My Most Interesting Lighting Job" contest. The regional winners from among the chapters and sections in each region presented their entries in 10-minute concise and illustrated offerings to be judged as to difficulty of problem, ingenuity of solution, application to other similar circumstances and clarity of presentation.

In both Class 1, residential, and Class 2, commercial and industrial, the contestant from the South Pacific Region, which was in each case that from the Golden Gate Section, won prizes. R. L. Sawyier, Pacific Gas and Electric Co., San Francisco, won first prize in the region and fourth place in the national residential class. First in both national and regional was the joint entry of John Epperson of Peerless Electric Co. and Lloyd Dehrer of Buonaccorsi & Murray, consulting engineers, San Francisco, for the relighting of the banking floor of the Crocker-Anglo Bank. All were presented awards at the President's dinner concluding the convention.

Interestingly four of the contestants in the residential class who were unable to attend sent their presentation on a tape recording synchronized with a series of color slides. Among these was the top winner, F. Brendon Burke, an electrical contractor in Buffalo.

To the 150 local committeemen and their wives who staged the big show and handled its million details, especial praise was given by President Taylor. Headed by jovial John S. Walsh, manager of area development, PG and E, San Francisco, chairman, and his two lieutenants, Arthur S. Tylor, Corning Glass Works, in charge of operations, and William L. Friend, Sylvania Electric Products, in charge of program facilities, were 19 well-organized committees. They coordinated perfectly to make it a smooth-running, successful show despite two holidays, a teamsters' strike and several other conventions in town.

For entertainment these committees provided the Cathedral spectacle, a deep sea fishing trip, a chuck wagon barbecue and a golf tournament at Orinda, a Chinese fashion show, wine country tour and boat rides for the ladies. Many of those attending continued on a post convention trip by steamship to Hawaii.

Ernest Nelson, new president, SW Section; Roy Stanley, telling of fatal swim pool accident; C. Hefner, president; Lou La Fehr, secretary

Inspectors Check New Code

If anyone expected hot arguments over the National Electrical Code at either of the two annual meetings, of the Northwestern Section, International Association of Electrical Inspectors, or the Southwestern Section, they were surprised by the peaceful calm that pervaded both. Perhaps the fact that the new 1959 edition of the code just reached the inspectors at these two meetings, giving them no time as yet to examine and criticize it, made it calm at both. Other opinions expressed, however, would indicate that generally the new code is satisfactory to inspectors after years of reworking it, and only minor changes may be needed.

The only controversy, and a mild and gentlemanly one, seemed to be one over aluminum or steel conduit, advocates of both addressing both meetings. Walter O. Zervas, research engineer, American Iron & Steel Institute, reviewed the history of conduit in wiring systems and evaluated the attributes of steel conduit in a paper at both meetings. Aluminum was represented by Leon Guibara, Kaiser Aluminum, in demonstrations from a traveling truck display. Herbert Ufer, Rome Cable Co., was in both camps since Rome's acquisition by Alcoa. He told the findings of that company's engineers that aluminum conduit was not considered suitable for service masts extending above the roof line.

Whether three-phase motors should have overload protection on all three phases has long been argued, particularly in the West, where irrigation pumping motor single-phasing causes so much corollary damage. But whether the code should require two or three, or

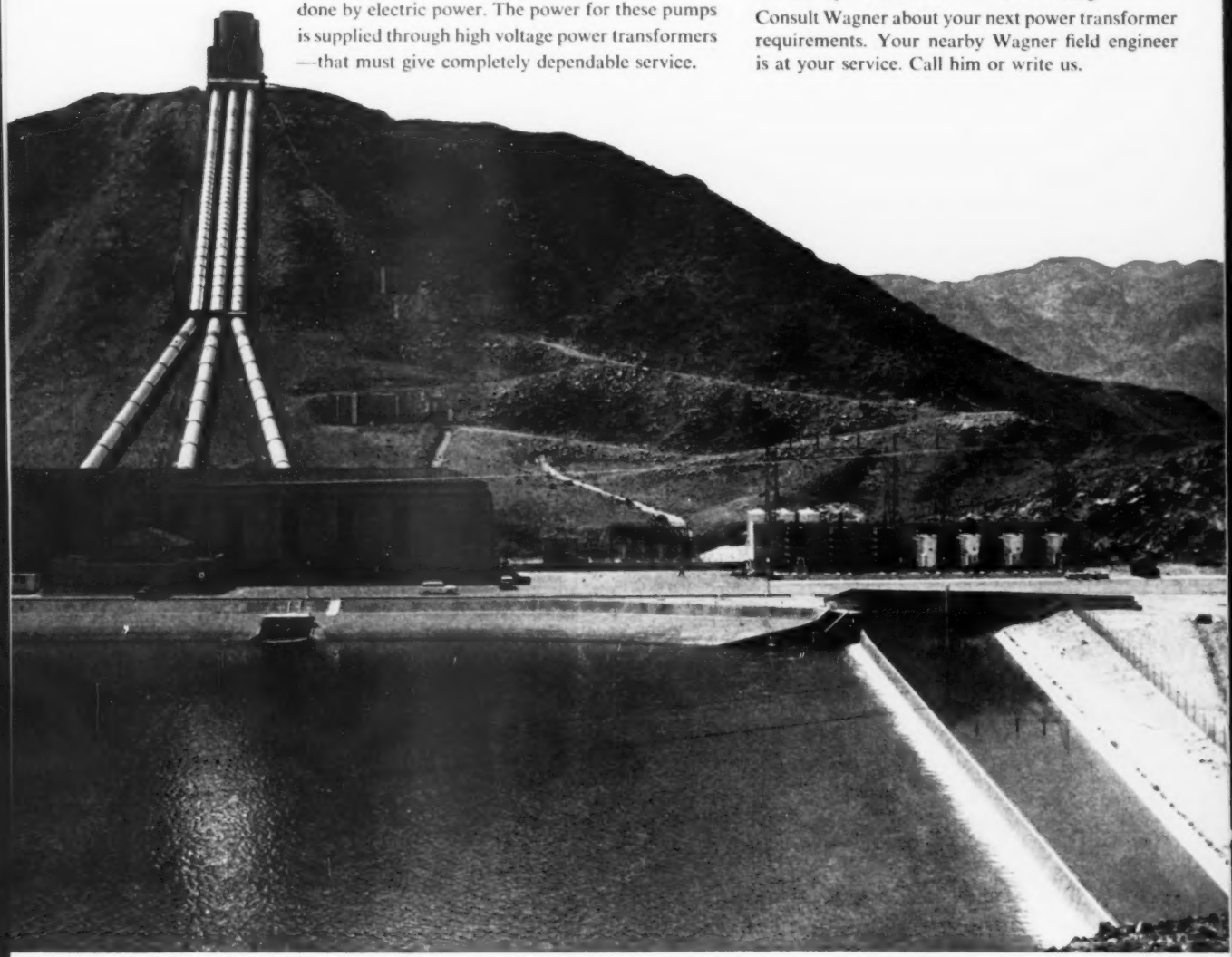
President James Paxton, NW Section (right) turns his gavel over to new President Joe Gray of Portland, with Eldon Shirley, Billings, Edward Tubbs, Bellingham, vice-presidents, and Secretary Bill Gaffney backing him up for his term of office

TEN 230 KV WAGNER POWER *DOUBLE* CAPACITY OF SOUTHERN CALIFORNIA

The Metropolitan Water District of Southern California extends into five California counties, and has a population of 7,000,000 people. Water from the Colorado River is carried by the District's aqueduct across the entire state of California through an aqueduct system 654 miles long. Pumping stations along the aqueduct lift the water 1617 feet over mountain barriers—a tremendous job, done by electric power. The power for these pumps is supplied through high voltage power transformers —that must give completely dependable service.

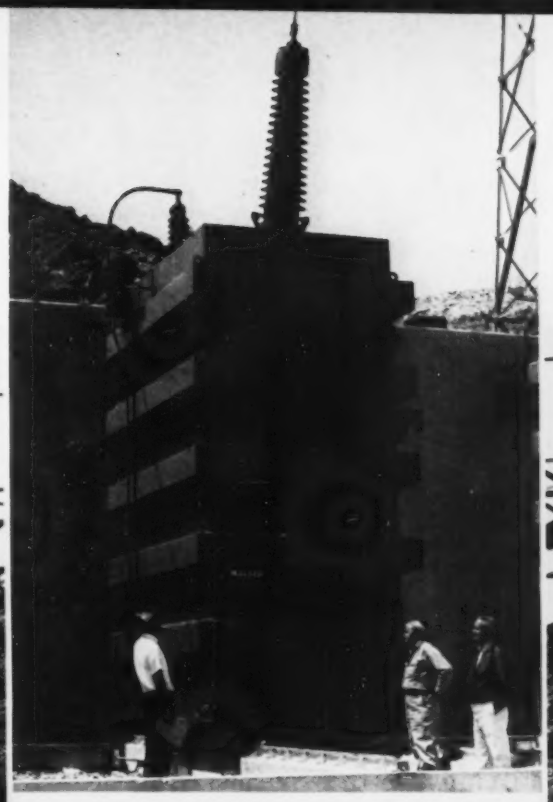
To fill the need for more water, the Metropolitan Water District recently installed ten Wagner 230,000 volt power transformers at three of the pumping stations along the system. Three of these transformers are rated 5500 kva—seven are rated 15,000 kva. They will help supply enough power to double the capacity of the system. The transformers are oil-immersed, water-cooled, with an alternate provision for forced-oil cooling.

Consult Wagner about your next power transformer requirements. Your nearby Wagner field engineer is at your service. Call him or write us.



MORE WATER FOR SOUTHERN CALIFORNIA is boosted over a mountain barrier at the Iron Mountain pump lift through three huge pipes, some 10 feet in diameter. Ultimately a billion gallons of water per day will be lifted through this pumping station.

TRANSFORMERS HELP WATER SYSTEM



One of the three 230 kv Wagner Power Transformers added to the Eagle Mountain pump lift.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation

6381 PLYMOUTH AVENUE, ST. LOUIS 33, MISSOURI

SERVING 2 GREAT GROWTH INDUSTRIES . . . ELECTRICAL . . . AUTOMOTIVE

WT59-12

Static electricity demonstrated by U. S. Bureau of Mines' Howard Polland, Denver

when, has never been satisfactorily decided. To aid in a more complete solution, James W. Cooke of General Electric Co., speaking at both meetings as representative of the industrial control section of NEMA, told of a forthcoming survey to be made and asked full support of it. The survey will be conducted by Underwriters' Laboratories and all parties in any way affected will be questioned for their facts, figures and opinions. These will be correlated and submitted to Panel 11 for consideration in preparation for the next edition of the code.

Rene La Belle, Montreal, Quebec, chief inspector, International president, addressed both meetings briefly. Only the second president of IAEI (A. G. Hall of Toronto was first in 1935-36) from Canada, President La Belle earnestly admonished inspectors to live up to their prime responsibility to their fellow citizens in safety to their lives and property. He commended the friendship between Canada and the United States and extended an invitation to all to visit him in Montreal.

Everett Cogan, IAEI secretary-treasurer, reported good financial condition for the association and relatively small loss of members since the increase in dues. Frank Stetka, field engineer, NFPA, brought copies of the new code edition for all attending and announced that all inspectors would be sent a copy. Stetka called attention to the new numbering system, and to several editorial changes. A cross-index in the back gives the new paragraph number for every one in the old code. Where a change in substance was made it is indicated by bold-face type.

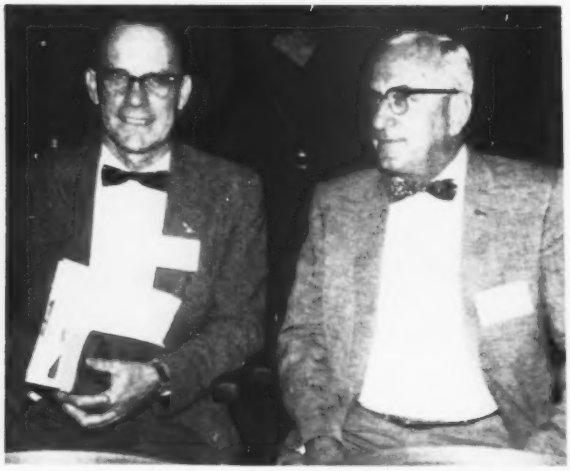
Articles of Association changes, one to speed up procedure for processing proposed code changes, the other to remove the free membership accorded those in the armed services, were ratified by both conventions.

Northwestern Section

Outstanding feature of the Northwestern Section, meeting at the New Washington, Seattle, Aug. 24-26, with James A. Paxton, Spokane chief inspector, president, were two talks on static electricity. This meeting had the section's largest attendance, 200 men and women, and interest was high even if discussion was low. In its business session the new by-laws for the section were adopted as presented by Past President Hal Morr, Salt Lake City.

Higher secondary distribution voltages for commercial installations was made the subject of a panel discussion following a talk by Reed of General Electric Co. on "Fault Current." The latter described the action of fault current in service equipment and showed new devices designed to contain such faults safely.

On the panel on higher secondary voltages were Walter Gordon, Tacoma consulting engineer, Lysle Gleason, Seattle, W. A. Gallotte, Pu-



Left, from national office—Everett Cogan, IAEI secretary; Frank Stetka, NFPA engineer. Right, Ray O'Leary, Northwestern conference chairman, and Bill Gaffney, NW Section, secretary-treasurer. Between them all arrangements were coordinated

get Sound Power & Light, and Bert Hardy, Tacoma chief electrical inspector. Brought out in the symposium was: that higher voltages mean savings to customers; that dry-type transformers can be used with success; typical voltages include 120/208-v Y, 277/480-v Y, 240/41-v Y, 265/460-v Y; that grounding and bonding must be done with great care; that mixed voltages in the same raceway make color coding very important, especially where neutrals are employed.

No two speakers could have fitted so well into a program to enlighten inspectors as to some of the less understood complications relating to static charges and hazardous locations, particularly hospital operating rooms, as Howard Polland, U. S. Bureau of Mines health and safety engineer, and Kent Stiner, former inspector, now with BullDog, Detroit. Polland, describing the nature of static electricity as compared to "current" electricity and demonstrating how easily it is generated, set the stage for Stiner, who talked of means to control and drain it off safely.

New Mexico Chapter joined the Southwestern Section and sent George Kolb, Albuquerque inspector, Mrs. and Robert Thompson, state electrical engineer, E. S. Butt, inspector

Polland showed that static charges are generated when two substances of somewhat different character touch and then separate, whereas current depends upon magnetism. He advocated proper grounding, bonding, use of static detectors, humidification and elimination of nonconducters as much as possible in hazardous locations.

Stiner, for 10 years a member of the NFPA committee 56 for the inspectors, told of the preparation and adoption of the Hospital Operating Room Safe Practices code published by NFPA as Bulletin 56. Since the National Electrical Code does not cover this problem he advocated that city and state legislation adopt the standard. He stressed the necessity for following all, not parts only, of the requirements and that rigid rules for personnel and maintenance be enforced.

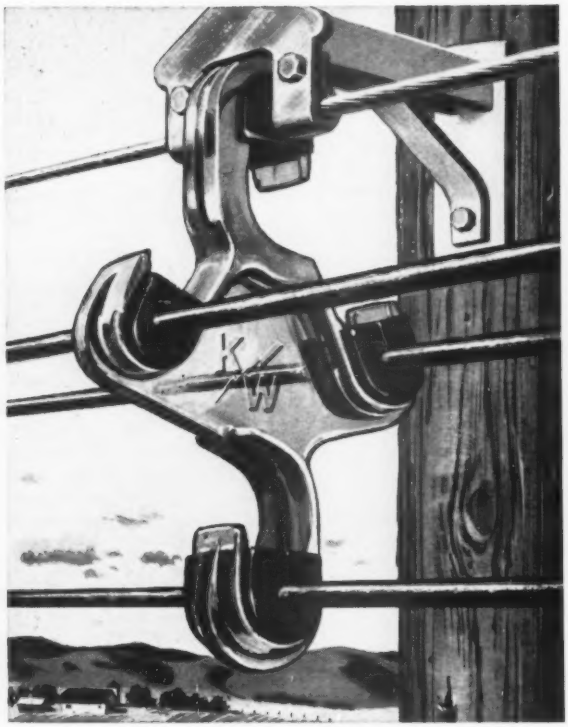
A code panel, consisting of Beverly Travis, consulting engineer; chairman, H. B. Whitaker, Underwriters' Laboratories, New York; Kent Stiner, BullDog; Chris Klawa, Oregon State; H. H. Watson, G-E, Bridgeport; Edward Tubbs, Bellingham inspector; Cliff Atkins, Oregon State, heard questions and sought to give answers. Only two motions for code changes were passed: (1) That no dual ratings on caps and receptacles be allowed (Gray reported an electrocution from a cap entering wrong and energizing the grounding wire); (2) that fixtures be marked with temperature limitations if wire used comes within 3 in. of the lamp ballast.

In the election of officers Joe F. Gray, Portland chief inspector, was skipped a grade to be the new president; Edward M. Tubbs remained first vice-president; Eldon Shirley, Billings, became second vice-presi-

At left, IAEI President Rene La Belle, Montreal, with Chester Hefner, SW Section president. Right, Thomas Saunders, new

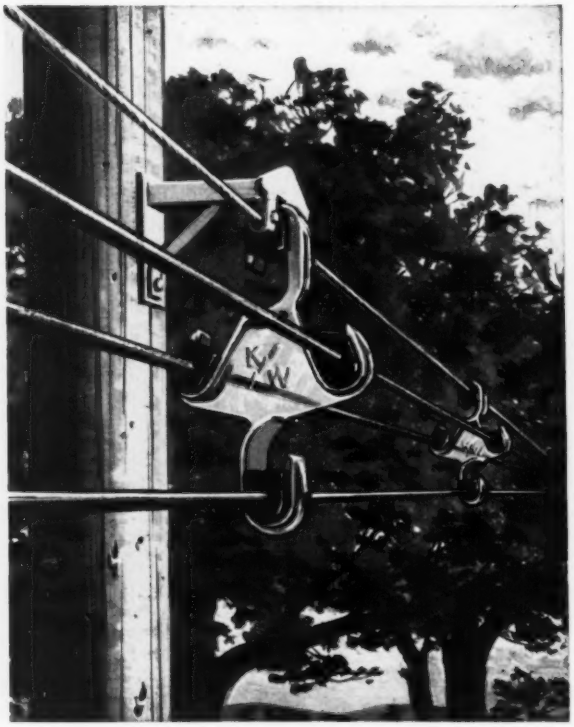
chief of California Division of Industrial Safety, with E. E. Carlton, chief electrical safety engineer, IAEI third vice-president

NEW K/W SPACER TYPE AERIAL ADDS STRENGTH, CUTS COSTS,



One-Piece Design—Supports 1200 Pounds

New solid spacer design has no loose parts nor movable pieces . . . it's simple, reliable and strong. Can support a minimum distributed load of 1200 pounds. Easy to install, since only one conductor is handled at a time. Snap-in grommets shaped to ease installation. Can be used with or without crossarms; standard hardware available from many suppliers.

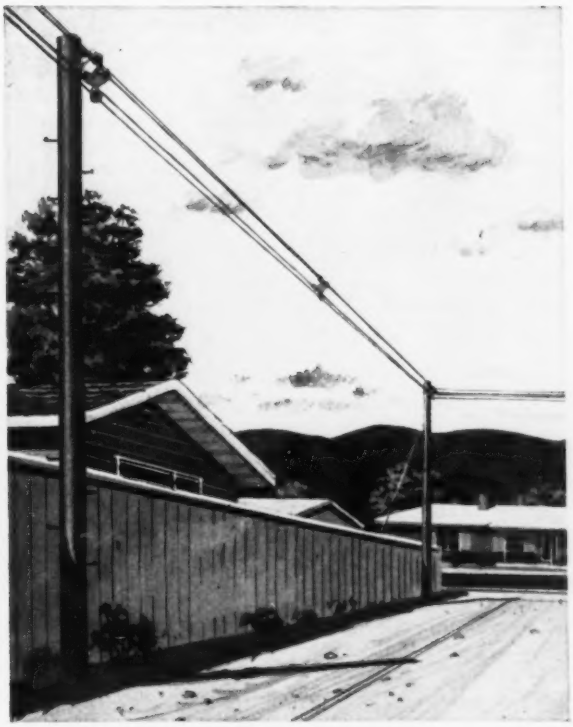


Cuts Material Costs and Tree Trimming

A KW Spacer Cable system can be installed for as little as one half the cost of standard pre-assembled aerial cable!

Compared to open-wire weatherproof, the reduced tree trimming and improved system dependability resulting from messenger supported cables can justify the spacer system's slight additional cost.

CABLE SYSTEM IMPROVES APPEARANCE



Reduced Spacing Improves Appearance

Compared to open wire, closely spaced conductors present a neat, compact arrangement that improves appearance wherever it is installed. Close 6-inch spacing also improves system electrical characteristics . . . permits easy phase identification and proper load balancing. Usual installation practice is approximately 35 spacers per 1000 feet.

WITH its unique new spacer design, KW now offers you unsurpassed dependability and handling ease for cable systems operating at 5 to 15 kv, by using only one spacer for the whole range of voltages.

No tools or tightening necessary: entire spacer system snaps in and locks.

The system consists of four parts: (1) Phase conductors (EC grade aluminum, minimum conductivity 62 per cent, insulated with Polyethylene or Butyl rubber with Neoprene jacket); (2) Special high-strength messenger; (3) Molded one-piece spacers; (4) Molded Neoprene cable-retaining grommets.

Standard hardware is available from leading suppliers. Call your Kaiser Aluminum sales office or KW distributor for immediate service and full information.

Kaiser Aluminum & Chemical Sales, Inc., 1924 Broadway, Oakland 12, California.

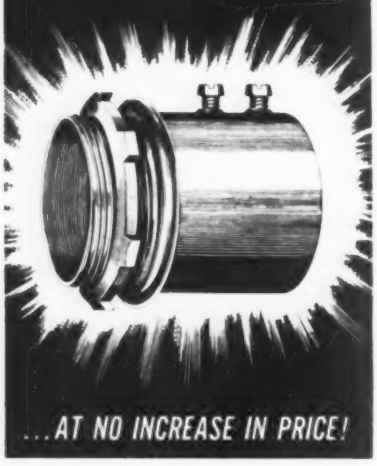
KAISER ALUMINUM

"IF IT CARRIES CURRENT, KW CARRIES IT!"

See "MAVERICK" • Sunday Evenings, ABC-TV Network • Consult your local TV listing.

For phone number of closest representative see advertising index in back of book.

NOW...all UL ETP fittings are Chromate Plated FOR LASTING PERMANENCE!



...AT NO INCREASE IN PRICE!

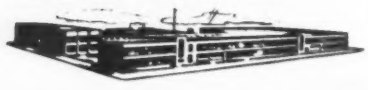
Concrete tight! Every size connector and coupling up to 2". Why settle for ordinary fittings when ETP gives you all this:

- New sparkling Zinc Chromate overplating for lasting permanence. Salt spray tested to retard corrosion.
- Exclusive pre-set, deep-slotted STAKED screws. No backing out for conduit.
- Concrete tight with heaviest gauge wall thickness. U.L. file card E24788.
- Precision bevelled edges with extra heavy duty locknut.
- One piece solid tubular steel—cannot open or spread. Sized for uniformity.
- Available in ½", ¾", 1", 1¼" (one screw type) and 1½" and 2" (two screw type)

CONNECT WITH ETP FOR ECONOMY

WEST COAST REPRESENTATIVES:
WEINGART & LUSTIG
1567 E. 25th Street Los Angeles 11, Calif.
ADams 3-4111

ETP



ELECTRIC TUBE PRODUCTS
74-16 Grand Avenue, Maspeth (N.Y.C.), N. Y.

dent and W. L. Gaffney was re-elected secretary-treasurer. On the executive council Cliff Atkins, Oregon State inspector, was named candidate, H. S. Morr, Salt Lake City, delegate, W. R. Volheye, Oregon state chief inspector, and Joe Gray, alternates. On the executive committee Loren Christensen, Salt Lake inspector, Mark Lundy, Idaho chief inspector, J. D. Gawne, Seattle City Light; J. Hyde Stayner, Utah Power & Light; T. M. Widrig, General Electric; Beverly Travis, Seattle; and James Paxton, Spokane, were named.

Southwestern Section Code Shops

With even more success than in previous years, the Southwestern Section met 250 strong at the Flamingo, Santa Rosa, Aug. 31-Sept. 3 and made its three code workshops the backbone of the annual meeting. In addition to the previously mentioned speakers addressing both meetings, this section, presided over by President Chester Hefner, San Mateo county inspector, heard only one more speaker, the new chief of the California Division of Industrial Safety, Thomas N. Saunders. Even the time was extended to a four-day meeting to better accommodate the workshop idea. Incoming president Ernest Nelson, San Leandro chief inspector, who organized and conducted the workshops, declared that next year's workshops would probably increase in number so that one on public relations for the inspector could be provided.

President Hefner stressed the importance of chapter activity, calling chapters the roots of the organization. He spoke especially of the interchange of opinions and comment and felt that with such training, plus the promised courses for electrical inspector training being prepared by the section educational committee the day when inspectors could rise to professional status would come sooner.

The New Mexico Chapter, long a part of the Western Section, was welcomed into the Southwestern Section and thought given to future annual meetings in that state.

Saunders announced that revision of the California State Safety Orders were in process and invited inspector participation. It is important that the orders not lag behind new electrical developments, he said. He praised the cooperation existing between city and county inspectors and the state inspectors and hoped to increase the staff to cover industrial farms.

The important changes in the new 1959 edition of the National Electrical Code were detailed prior to the workshops by H. B. Whitaker, Underwriters' Laboratories, New York, who became the new secretary of the NFPA electrical code correlating committee when Merwin Brandon became president of UL.

Presiding over the individual workshops were: Residential—Horace Lee, Oakland, chairman; Howard Reymers, UL, secretary; Commercial—Anthony F. Nastro, Sacramento, chairman; O. G. Wedekind, UL, secretary; Industrial—L. O. Trim, Burbank, chairman, Charles T. Brooke, secretary. Each workshop was well attended and discussion was rampant. Out of the discussion jelled certain definite recommendations for code changes which were then brought before the entire body for ratification on Wednesday afternoon and Thursday morning.

Meanwhile in such discussion, particularly with members of the national code panels present (such as H. H. Watson, Kent Stiner, M. Brandon, H. B. Whitaker, Arthur Veit, etc.) clearer understanding of code intent and meaning was engendered. Some 18 proposals for changes, some minor, were voted as submitted by the workshops. These will go on through the procedure toward the next code.

Endorsement was given a proposal which Eustace Soares has submitted to change Article 250-53 making mandatory the use of a common grounding conductor in order to provide a low impedance fault path.

Death caused by breakdown of submersible lighting units in a swimming pool brought action to correct conditions found by interim amendment rather than waiting until the next code. Another important change voted was to permit lighting equipment of higher voltages less than 8 ft from the floor if properly installed.

Carsten Henningson of General Electric computer department appeared before the industrial workshop to explain that because of extreme sensitivity of certain functions of transisters in computing machines it is impossible to comply with the grounding rules in the code. He was asked to submit definite proposals to the proper panel for its consideration of the new problem.

Election of officers advanced Ernest Nelson, San Leandro, to president, Arthur P. Vesco, San Diego inspector, to first vice-president;

The culmination of 15 years of research on the protection of transformer tanks and covers from

water, ice, smog, sun, salt spray and wind

NOW...
Pennsylvania Transformer proudly introduces
THE NEW

V.I.P.*

FINISH
for all Pole Star Distribution Transformers and Regulators

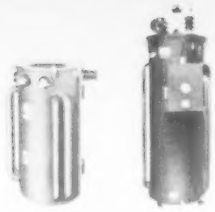
*Vinyl with Inner Phosphate

V.I.P. ...is not just a preparation...is not just a paint
...is an ALL NEW FINISH that will double the tank protection of your transformer IN ALL LOCATIONS

Pennsylvania POLE STAR Distribution Transformers and Regulators

PENNSYLVANIA TRANSFORMER DIVISION
McGRAW-EDISON COMPANY, CANONSBURG, PA.

Turn page for V.I.P. details



Here is what V.I.P. Finish does for your transformer and regulator tanks:

V.I.P FINISH

Pretreats tank surfaces to resist corrosion
Prevents spread of rust if scratches occur in handling
Provides extra high resistance to moisture, alkali, acids
Protects against incipient corrosion at edges, corners
Produces high-gloss finish that long retains its luster

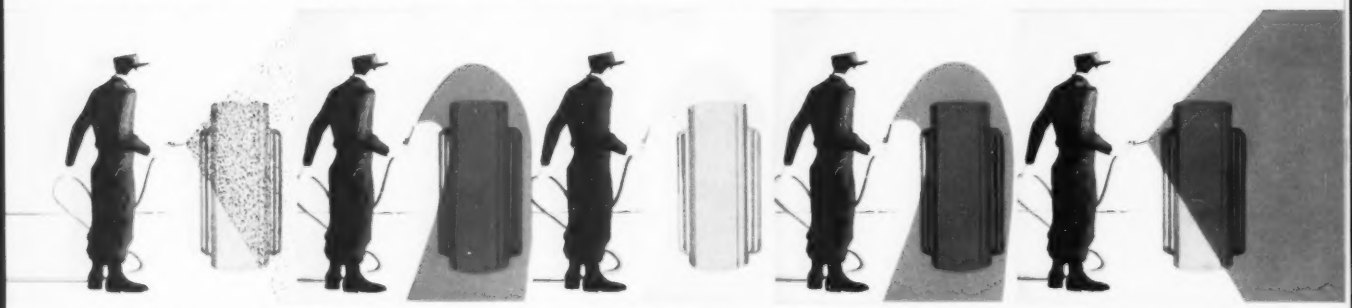
The new V.I.P. Finish for Pole Star Distribution Transformers and Regulators is *more* than a paint. Basically a *vinyl* finish with an *inner phosphate* coating, V.I.P. Finish gains its outstanding characteristics from careful preparation and pretreatment of the metal, followed by meticulously controlled application of the various coats.

A principal reason for the amazing weatherability of V.I.P. Finish is that it provides not only extra-high *primary* resistance to moisture, alkali and acids . . . but also sets up a secondary or insurance barrier that prevents the spread of corrosion if any bare metal becomes exposed, as in the case of accidental scratching. Such spots can be touched up with complete assurance that no underfilm corrosion will occur.

V.I.P. Finish is designed to save maintenance costs, even when transformers and regulators are exposed to the most highly corrosive atmospheres. Tests prove this. To take advantage of new V.I.P. Finish on your next distribution transformers or regulators, contact Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pennsylvania.

McGRAW EDISON

THIS IS THE 5-STEP V.I.P. PROCESS THAT PROVIDES ALL-WEATHER, ALL-CLIMATE PROTECTION FOR POLE STAR DISTRIBUTION TRANSFORMERS AND REGULATORS



1. In the first step, all exterior surfaces of the tank—made of copper-bearing, corrosion-resistant steel—are shot-blasted with steel grit. This removes all scale, grease and dirt, and also provides "toothage" for adhesion of the first coat to the steel surface.

2. A combination chemical pretreatment and primer applied by the flow method simultaneously form a phosphate coat and thin organic film on the clean metal. This is the V.I.P. step that prevents the spread of corrosion, even if the metal is scraped bare in spots.

3. A tough vinyl combines with non-leafing aluminum to form an almost impenetrable surface against moisture or moisture vapor.

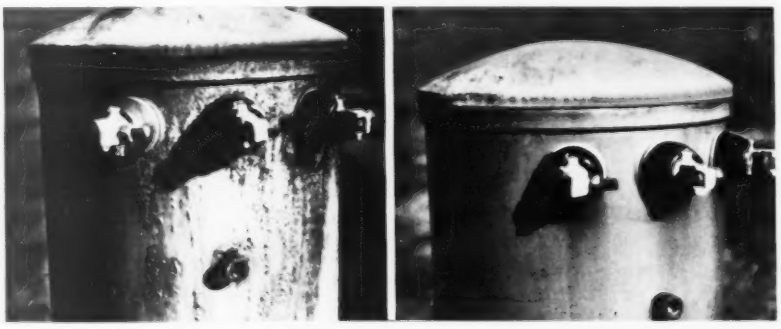
4. An alkyd-titanium paint (used successfully on Pole Star transformers for many years) is flowed on to provide a heavy uniform coverage.

5. A final spray coat of blue-gray alkyd-titanium paint assures a smooth finish with a maximum gloss. This, together with the preceding coat, forms a hard, elastic finish that resists weathering.

The V.I.P. Finish provides a total thickness of 3 to 4 mils for extra heavy protection. All coats are oven dried at controlled temperatures.

LIFE TESTS AND ACCELERATED TESTS SHOW SUPERIORITY OF NEW V.I.P. FINISH

Both transformers shown here were exposed for 2500 hours in a salt spray cabinet, then were placed outdoors in an industrial atmosphere for 2½ years. The transformer protected with V.I.P. Finish (on the right) shows hardly any effect from its ordeal, whereas the other transformer—which started with a good finish by previous standards—is badly corroded.



Pennsylvania POLE STAR Distribution Transformers and Regulators

Charles Pierce, Fresno inspector, second vice-president; Paul Davidson, Phoenix inspector, was made the new third vice-president and Lou La Fehr, Alhambra inspector, re-elected secretary-treasurer. To the executive council E. E. Carlton, California State, and Arthur Veit, Los Angeles County inspector, were returned, with Chester Hefner and Barney Alverson, San Bernardino County, as alternates. To the executive committee there were named: Chester Hefner, past president; Kearny Byland, Arizona Chapter; George W. Hayden, Central California Chapter; E. Warren Small, Hawaii Chapter; I. J. Sandorf, Nevada Chapter; D. H. Hansen, Northern California Chapter; Lester Wolditt, Sacramento Valley Chapter; E. V. Muller, Southern California Chapter; George A. Kolb, New Mexico Chapter; H. K. Winterer, retired; H. G. Ufer, Rome Cable Co.; and W. A. Cyr, ELECTRICAL WEST, associate members.

Next annual meeting of the section will be held at the Mapes Hotel at Reno, Sept. 18-21, 1960, it was announced by La Fehr.

Meetings Calendar

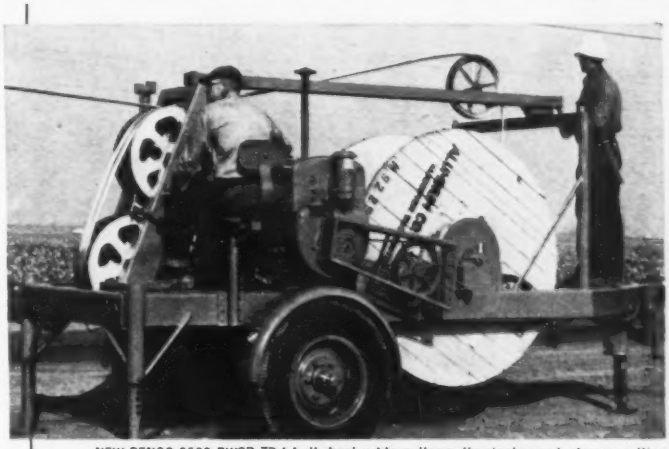
OCTOBER

1—*Bureau of Home Appliances*, San Diego, fall conference, Balboa Park.
2—*National Industrial Services Assn.*, Northwest conference, Seattle.
16-17—*NISA*, Utah-Rocky Mountain Chapters conference, Salt Lake City.
25-29—*Rocky Mountain Electrical League*, annual convention, Broadmoor Hotel, Colorado Springs.

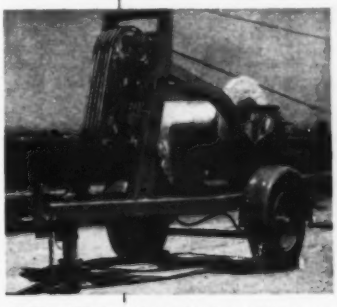
NOVEMBER

5-6—*Pacific Coast Electrical Assn.*, Hawaiian conference, Princess Kaiulani Hotel, Honolulu.
12-14—*Canadian Electrical Assn.*, Western Zone, General and Sales Division meeting, Bessborough Hotel, Saskatoon, Sask.
16-17—*PCEA, Administrative Services*, Rickey's, Palo Alto, Calif.
16-18—*CSA*, Engineering Divisions, Palliser Hotel, Calgary.
18-20—*Inter-Industry Farm Electric Utilization Council*, 6th annual National Electric Farm Power conference, Westward Ho Hotel, Phoenix.
27-Dec. 2—*San Diego Bureau of Home Appliances*, annual Electrical and Home Appliance Show, Electric Building, Balboa Park, San Diego.

Now—A budget priced **PENGO TENSION STRINGING "TEAM"** for faster, safer, lower cost wire stringing!



NEW PENGO 5500 BWCP TR-I bullwheel cable puller pulls single conductor or pulling line, at tensions to 1,700 lbs. at 3 mph in high gear, or to 3,100 lbs. in low. Takes reels to 44" wide by 69" diameter. Neoprene-lined bullwheels take manila rope to 1¼" diameter; or smaller pulling lines and conductors. Powered by 25 hp gas engine; 2 man operation. Ideal for use with PENGO 5000 series tensioners (see below).



PENGO 5000 STR-I-34 combination tensioner and reel dolly has Neoprene-lined bullwheels to take conductor sizes up through .96 (565, 500 CM), handles reels to 34" x 72". The PENGO 5000 STR-I-54 is similar but larger and stronger, for larger and heavier reels to 44" x 72"

Here's a chance to gain all the economy, speed and safety of *tension* wire stringing at an investment that won't strain your line construction equipment budget.

The new PENGO 5500 Bullwheel Cable Puller pictured above, teamed up with a PENGO 5000 series tensioner, gives you a wire-stringing combination that keeps the conductor in the air all the way, makes it easier and safer to string over energized lines.

PENGO tension wire stringing equipment is available for any size conductor, for all stringing conditions. You'll be hours and dollars ahead to consult us *now* on planned line construction. We invite your inquiry. Dept. F 10

New PENGO-MILLER Line Stringing Swivels

Special models of the well-known MILLER swivels have been redesigned specifically for tension line stringing use, through collaboration between Petersen Engineering Co., Inc., and Miller Swivel Products, Inc.

The result is a reliable, heavy duty swivel of proper dimensions to pass through stringing sheaves and bullwheel grooves easily, without damage.

PETERSEN
ENGINEERING CO., INC.
Santa Clara, California

Telephone AXminster 6-7712

B-8

"Service means

A Statement of Policy from Jim Grindell, General Sales Manager
Killark Electric Manufacturing Company

We are proud of the position Killark occupies as the leader in manufacturing aluminum conduit fittings and fixtures. That leadership results from pioneering the use of aluminum, steadily expanding our line and following a dedicated policy of service to the contractor and wholesaler. Killark can give you these advantages.

1. *Long-term Experience.* More than FORTY-FIVE years' experience in the manufacture of conduit fittings, together with almost twenty years as exclusive manufacturers of ALUMINUM fittings gives us the "know-how" that comes with time and experience. Killark is the pioneer in this field.

2. *Modern Design.* We are continually improving design and expanding the line by adding new items. Aluminum fittings have definite advantages in that they are rust-free, more corrosion resistant, lighter and therefore easier to use.

3. *Complete Line.* Not just a few special-purpose products, but a *full* line in a complete range of sizes. In fact, Killark offers the most complete line of all-aluminum fittings and fixtures in the country today, and they are competitively priced.

4. *Efficient Distribution.* The United States and Canada are thoroughly and efficiently covered by 27 experienced Electrical Agents. More that half of these men have been with us 25 years or more. There are 20 strategically located warehouses from which prompt delivery is made, giving you faster service.

KILLARK ST. LOUIS

ELECTRIC MANUFACTURING COMPANY

Vandeventer and Easton Aves. • St. Louis, Missouri

America's Most Complete Line of Aluminum Fittings & Fixtures

OVER 4500 ITEMS...

many things at Killark"...

SERVICED BY 27 KILLARK REPRESENTATIVES...

ATLANTA 8
Ernest T. Loyd, Inc., 69 Mills St., N. W.
BALTIMORE 27
Eastern Sales Co., 1561 Lister Rd.
BOSTON 27
Electrical Agencies, Inc., 49-51 "D" St.
BUFFALO
Eberhardt Electric Sales, 278 Johnson St.
CHICAGO 12
Jack L. Rowe & Son, 2039 W. Jackson
CINCINNATI 37
Arthur L. Ehlers Co., 1031 Meta Drive
CLEVELAND 14
Lusty-Thomson Co., 2140 Hamilton Ave.
DALLAS 2
Geo. E. Anderson Co., 1901 Griffin St.
DENVER 4
Kenneth B. Schumann Co., 1073 Galapago St.
DETROIT 14
Riecher Electric Sales Co., 8319 Mack Ave.
KANSAS CITY 8
Wm. B. Terry Organization, 616 W. 26th St.
LOS ANGELES 33
Kenneth Anderson Co., 123 South Myers St.
MILWAUKEE
Martin-Gaertner Sales Inc., 1108 North Third
MINNEAPOLIS 2
Harry P. Smith Co., 826-27 Andrus Bldg.
NEW YORK CITY 33
W. J. Wickenheiser Co., 600 West 181st St.
OMAHA
W. C. McConkle, 8115 Gold Ave.
PHILADELPHIA 3
Harry G. Anschuetz Co., 113-115 N. 23rd St.
PHOENIX
Kenneth Anderson Co., c/o Mr. Melvin C. Long, 422 S. 7th Ave.
PITTSBURGH 9
Crescent Sales Co., Inc., 4830 McKnight Road
RICHMOND
W. E. Sullivan, Jr., 6211 A West Broad St. Rd.
SAN FRANCISCO
F. M. Nicholas Co., 714 Harrison St.
SEATTLE 4
Northwestern Agencies, Inc., 4130 First Ave., South

CANADIAN REPRESENTATIVES

EDMONTON, ALBERTA
A. H. R. Louden Agency, 7608—88th Ave.
MONTREAL, QUEBEC
Harry J. Issenman, 5235 Kensington Ave.
REGINA, SASKATCHEWAN
MacKay-Morton, Ltd., 2226 Dewdney Ave.
TORONTO, ONTARIO
Hodgson & Powell Co., Ltd., Box 123, Postal Station K, 1909 Yonge St.
VANCOUVER 9, BRITISH COLUMBIA
Griffon Sales Limited, 551 West 8th Avenue
WINNIPEG, MANITOBA
MacKay-Morton Limited, 183 James Ave., East

...AND DISTRIBUTED FROM 20 COAST-TO-COAST WAREHOUSES

ATLANTA
BOSTON
BUFFALO
PHILADELPHIA
PITTSBURGH
DETROIT
CINCINNATI
CHICAGO
ST. LOUIS
CLEVELAND
DALLAS
DENVER
SAN FRANCISCO
LOS ANGELES
SEATTLE
PHOENIX
CANADA
VANCOUVER
WINNIPEG
EDMONTON, ALBERTA
TORONTO

USS

Tiger Brand Electrical Wire & Cable

A standard cable for every special job

- Asbestos Wire and Cable
- Mold-Cured Portable Cord
- Shovel & Dredge Cable
- Paper & Lead Cable
- Varnished Cambric Cable
- Interlocked Armor Cable
- Special Purpose Wire & Cable
- Aerial, Underground and Submarine Cable

What's the difference in electrical cable?

New USS Tiger Brand Amerbestos—Type IPE withstands both high temperature and moisture

Type IPE stands for Irradiated Polyethylene. By combining IPE insulation with asbestos in our new Tiger Brand Amerbestos Cables, we get excellent resistance to both high temperature *and moisture*.

Conventional asbestos-varnished cambric cables were good for high operating temperatures but had little resistance to *moisture*.

The new irradiated polyethylene-asbestos cable, Type IPE, is superior in every way to conventional AVA cable and it costs you no more. You get the same physical dimensions, finished appearance, and safe operating temperatures.

Subjecting the polyethylene to a high voltage electron beam causes it to lose its thermoplastic nature, thus permitting its operation at much higher temperatures. Polyethylene so treated is known as "irradiated polyethylene" and the process has proved highly successful in severe field applications.

The big difference is that you can now use the cable for many more applications such as outdoor crane wiring, forced draft fan motors for boilers and other locations requiring high resistance to both heat *and moisture*. For more information, write American Steel & Wire, Dept. 9211, 614 Superior Ave., N. W., Cleveland 13, Ohio.

USS, Tiger Brand and Amerbestos are registered trademarks

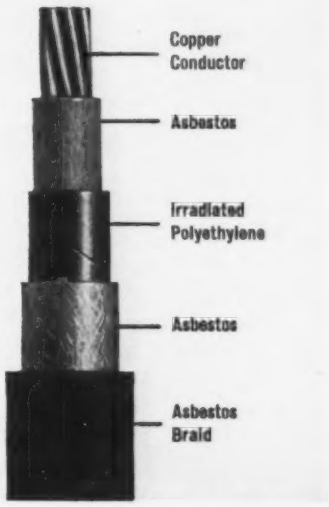
American Steel & Wire Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, Distributors Abroad

Test results show superiority of Amerbestos Type IPE Cable

Three 5-foot samples each of Type IPE and Type AVA Cable were wound around a mandrel 8 times the diameter of the cable and then straightened. This was done on samples after heating 48 hours at 130°C. Samples were then immersed in water at 50°C for one week. Insulation resistance readings were taken during this immersion and directly before breakdown. The IPE polyethylene insulated cables retained their high insulation resistance averaging 333,000 megohms against 36.9 megohms for the varnished cambric AVA cables.

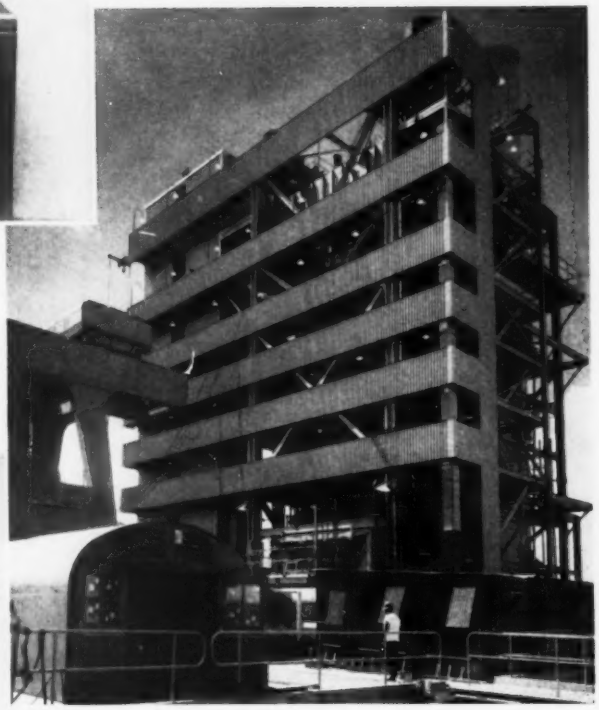
Dielectric Strength average: Polyethylene 31.2 KV, varnished cambric AVA 7.06 KV.



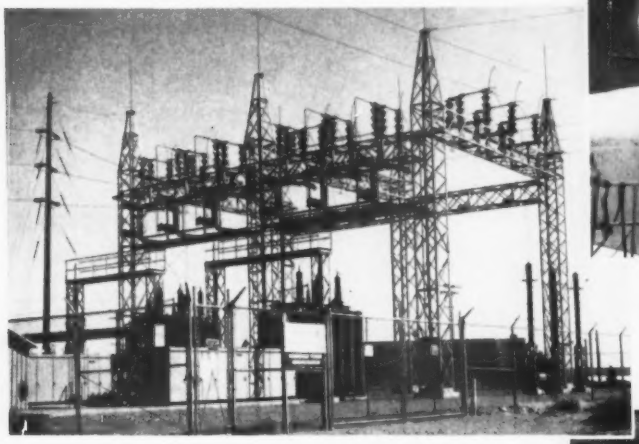
For phone number of closest representative see advertising index in back of book.

news

Kelman Electric Co., Los Angeles, has put its new development laboratory into service. Engineer at the console controls currents as high as 200,000 amp while testing new design ideas

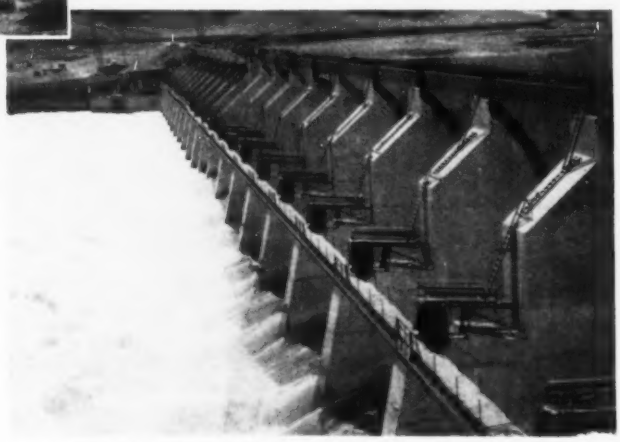


The new 60,000-kw generating unit at right will be going on the line for Hawaiian Electric Co. at about the time you are reading this. It brings the HECO system to a capacity of 400,000 kw



Thayer Drive substation at Richland, Wash., is one of two Bonneville Power Administration installations that supply power to the electric system that will be taken over this fall by the city of Richland from Atomic Energy Commission

Public Service Co. of Colorado has begun construction of this 12-story office building at 15th and Welton in Denver



The impressive spillway of Priest Rapids Dam of Grant County PUD is 1,142 ft long, and has 22 bays. Present contract with Merritt-Chapman & Scott Corp. is $91,880,000, and addition of two more generators will bring the total to about $98,000,000. Work has just started on Wanapum Dam at a site upstream on Columbia from Priest Rapids

EW

Management

Burns Creek Attacked

Ed Naughton, Utah Power & Light Co. president, spoke out forcefully against the proposed Burns Creek project on the Snake River. Naughton attacked a statement by a ranking Bureau of Reclamation official which said, "these people—preference customers—now have contracts for power with the federal government and we believe that they should continue to receive from the federal government power to meet their growing loads."

Naughton pointed out that a logical extension of this reasoning would be for the bureau to build steam electric plants for preference customers whenever they run out of hydro power.

The project, admittedly a 98% power project, has been attacked by Senator Barry Goldwater of Arizona, and more recently by officials of the Idaho Power Co., the Utah-Wyoming coal operators unions and the NAM.

Seeks Increase

Public Service Co. of Colorado is planning to apply soon for an increase in electric and natural gas rates.

Robert T. Person, president, said an application for the increase is being prepared for filing with the Colorado Public Utilities Commission. The company was granted its last rate increase January 27, 1955.

Official figures compiled in 1958 show the present rate of return to be 5.5%, which is .5% below what the PUC authorized in 1955.

Five-Man Board Petitions

In an effort to expand membership on the three-man board of the Grant County Utility District, petitions bearing 1,500 names have been filed. The petitions seek to set up a five-man board.

At least 1,139 valid names are required to bring about an election. If the number falls short of that, State Rep. Roy Mundy, who brought about the petitions, will be given 15 days more to get the required number.

The petitions contend that a five-man PUD board would provide better county-wide representation and make it possible to spread the work load for better efficiency.

Labor Bucks Water Bill

The State Federation of Labor, AFL-CIO, recently voted down a proposed resolution that would put it on record as opposing California's $1.75 billion water plan because the project would deny collective bargaining rights to organized labor. The resolution, recommended by the California Association of Electrical Workers, would also ask Governor Brown to call a special session of the legislature in 1960 to provide for union organization, collective bargaining and prevailing wages on state water and power projects.

A final, watered down resolution adopted by the 2,000 delegates instructed Secretary C. J. Haggerty to "do everything in his power" to work for union organization, collective bargaining and prevailing wages on state water projects. It did not make these provisions conditions for opposing the forthcoming bond issue. Another electrical workers resolution—that the federation form a separate committee on power—was also defeated on the recommendations of the resolutions committee.

► Hearings are being held by the Utah Supreme Court to determine whether the State of Utah can tax real property owned by Moon Lake Electrical Association Inc. and the Uintah Basin Telephone Assn.

NEWS INDEX

Association Affairs	128
Growth	109
Management	109
Manufacturers-Distributors	123
Market Development	110
People	130

Tacoma To Raise Rates

Tacoma City Light Department will file a new rate schedule, reflecting an average increase of 7½%, with the board of utilities, Utilities Director Dean Barline declares. The board voted in June to authorize the formulation of a new schedule, but must give final approval before the new rates go to the City Council for action. The increase is the recommendation of a consulting firm, which recommended the raise to help finance the city's Cowlitz power project. The firm indicated that rates may have to increase up to 15% before the $150 million hydro project is completed, but recommended a 5 to 7% increase initially. Tacoma's average rates are currently the lowest of any major utility in the nation.

Growth

More Geothermal Power?

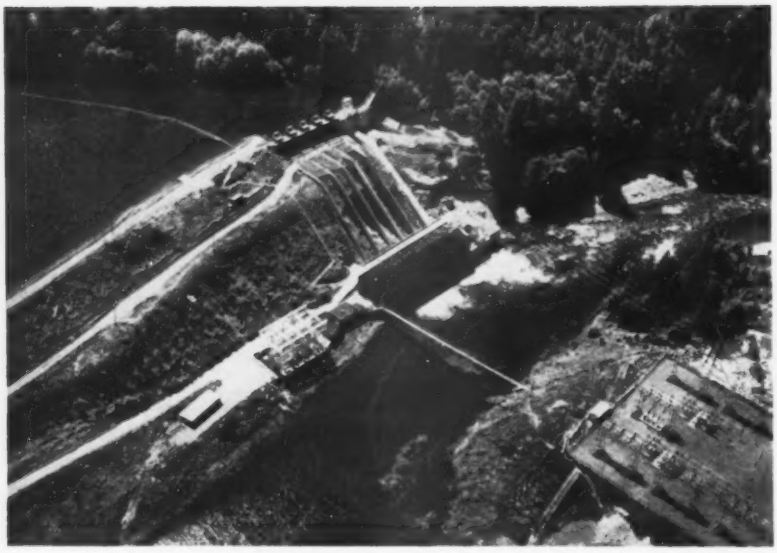
Successful completion of a steam well at Steamboat Springs, eight miles south of Reno, has been announced by Magma Power Co., developer of the steam wells in Geyserville, Calif., now being developed by PG and E.

Steam was encountered at 500 ft, and the well had a continuous output of steam capable of producing an estimated 4,500 kw of electricity. The well is currently being deepened with the expectation that the volume and pressure of the geothermal steam will be increased.

"This discovery can prove to be a very valuable addition to the basic economy of Nevada," stated B. C. McCabe, president, in announcing the new Magma well. "As a new source of cheap and abundant power, this well is urgently needed.

Most of the power for the Reno area is purchased from PG and E by the Sierra Pacific Power Co.

Sierra Pacific Power President Frank Tracy cautioned that the steam conditions were not suitable for power generation but he had confidence that if the proper steam



Faraday plant of Portland General Electric Co. now has a new 25,000-kw generator that brings total capacity to 44,000 kw. Faraday was first of PGE's five hydroelectric projects on the Clackamas River. It was completed early in 1906 and completely rebuilt after the plant "ran away" on June 21, 1908, and demolished all of the generators

was there Magma could find it. Sierra Pacific has an arrangement with Magma to utilize the steam for power generation when a proper quantity and quality are available. Tracy summed up: "We're interested—and hopeful."

► S. L. Sibley has announced the start of construction on PG and E's Geysers electric power generating station. Announcement by the steam producer indicates that steam wells are already producing in excess of the PG and E plant requirement of 250,000 lb per hour, but PG and E officials intend to wait until the present plant is in operation before making other capacity additions.

Also to start Oct. 1 is work on a power house on the Kings River.

► Washington Water Power Co. has announced construction will start on a 43-mile, 230-kv power line extending south from Lewiston, Idaho. The line will connect with a similar line being built by Idaho Power Co. and will link the Washington Water Power system with Idaho Power's Snake River dams. Cost of the line will be $1.5 million and will provide for an interchange of power between the two utilities. The line is routed within three miles of the proposed Mountain Sheep Dam on the Snake River, where the Pacific Northwest Power Co. has applied for license to build a dam. Completion date for the line is July 1960.

Market Development

New Service Center For Denver

Public Service Co. of Colorado has started operations in a new $1,250,000 electric service center at 2701 W. Seventh Ave., Denver. Center for customer electric service in the Denver metropolitan area, the office headquarters more than 360 employees and 125 vehicles. It repairs customer appliances, tests and maintains electric meters, engineers and maintains overhead and underground electric lines, transformers and substation equipment.

The center has a total floor area of 79,700 sq ft with a site covering nearly 9½ acres. A high level of light maintained throughout the facility consumes enough power to light 690 average homes. In areas where delicate testing equipment is used and where records are stored, temperature and humidity are precisely controlled the year round.

► Seattle's annual **Parade of Homes** was held the week of Sept. 29 through Oct. 7. Most of the homes were all-electric and six complied with City Light's Medallion Home requirements.

Drive Directed At Existing Homes

An electric range promotional campaign, aimed specifically at the market in existing homes, was launched Oct. 1, under sponsorship of the Los Angeles Department of Water & Power and the Los Angeles Electric League.

Consensus is that electric ranges are making up a fair share of the new construction market but, because of the cost of rewiring, they are losing out in existing homes.

To overcome this barrier a $35 cash wiring allowance will be paid through the dealer only. The allowance and the department's wire-on-time program, permitting wiring costs to be paid over a two-year period on the regular bills, will be mentioned in a series of metropolitan and community newspaper ads.

Theme of the advertising campaign is "Moderns Prefer Electric Cooking." The advertisements will feature the fact that the cost to a family of four amounts to only $1.75 a month.

The newspaper campaign will be supplemented with 12-ft posters on street buses, radio spots and point-of-sale material.

To stimulate wiring sales, a $10 commission will be paid to each salesman who sells a wiring job along with each range.

The campaign will run until Dec. 15 and will be reopened for the period from Jan. 15 to April 30.

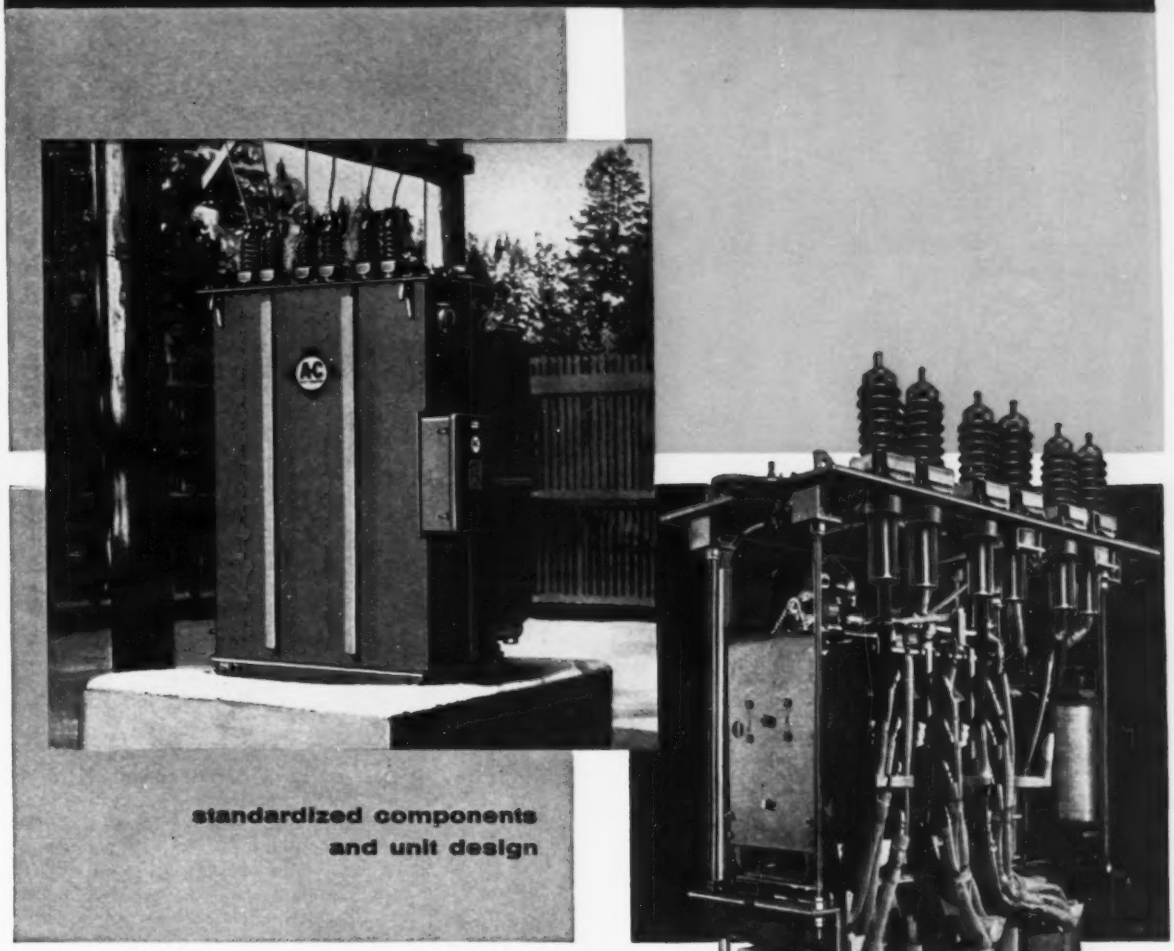
All-Electric School House

The first all-electric school in Puget Sound Power & Light Co.'s service area now is under construction and four others are nearing the construction stage. They will take advantage of Puget's primary service rate for such schools.

The Surrey Downs elementary school will use electricity not only for lighting but also for space heating, water heating and cooking, in accordance with plans of architects Mithun, Ridenour & Cochran. Ten warm air heating and ventilating units will serve 16 zones each with independent automatic temperature and ventilation control.

The all-electric installation was recommended to the school district by A. A. Morris & Associates, consulting mechanical and electrical engineering firm. The new rate reduces annual lighting costs by 50% and makes possible additional sav-

ALLIS-CHALMERS modern line for '59



why Allis-Chalmers 3-phase regulators

PACK MORE VALUE

Mass manufacturing of standard components — that's one reason why Allis-Chalmers can put so much value into industry's lowest-priced 3-phase regulators. Another key is *unit construction*. Simplified subassemblies are joined into a complete unit. Suspended from the cover, this "lift-out" unit makes interior readily accessible, assures you the best in construction.

More A-C regulator values: *Caliband* control, "Quick-Break" tap-changing mechanism, unidirectional breather and *Vari-Amp* rating.

Originators of 5/8% step regulators

Regulator facts fast! Call, wire or write...

ALLIS-CHALMERS

Caliband and Vari-Amp are Allis-Chalmers trademarks. A-1164E

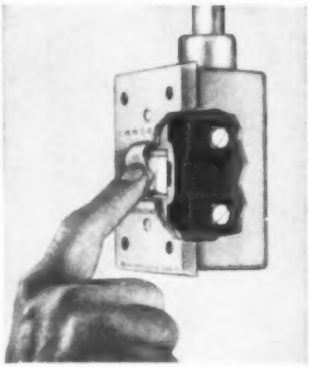
For phone number of closest representative see advertising index in back of book.

CAT. NO.
1751

WEATHERPROOF

*INSULPRENE PLATE and A.C. presSwitch COMBINATION

Introducing a combination unit—complete in one box—including weatherproof "Insulprene" plate and A.C. "Presswitch"... designed for all general outdoor applications: shipping areas, parking lots, gas stations, breezeways, etc. The weatherproof "Insulprene" plate fits both FS and standard wall boxes. The combination is available with 15 or 20 amp. "Presswitch" either single pole, double pole, 3-way or 4-way. "Insulprene" plate resists oil, hot water, live steam, extreme cold, grease, etc.



Cut-away shows A.C. "Presswitch" mounted in FS box and protected by new Weatherproof "Insulprene" Plate.

IT PAYS TO HAVE HUBBELL GOOD CONNECTIONS

*made of DuPont Neoprene

For complete information write

HARVEY HUBBELL, INCORPORATED
Bridgeport 2, Connecticut

WIRING DEVICE OFFICE AND WAREHOUSE LOCATIONS

Bridgeport 2, Connecticut
State and Bostwick Streets

Chicago 7, Illinois
37 South Sangamon Street

Los Angeles 12, California
103 North Santa Fe Avenue

San Francisco, California
1675 Hudson Avenue

IN CANADA:
Scarborough, Ontario,
1160 Birchmount Road

This new electric can opener, to be put into production by Sunbeam in the early fall, is claimed to be less than one-half the size of previous models. Available in both wall and portable models, the device has finger-tip, one-control action; has enough power to open any can, Sunbeam says. Safety features have been provided in the unit

---

ings in heating, in comparison with flame-type equipment, the Morris firm determined. Fluorescent lighting will provide illumination of 50 to 60 f-c at the working level in class rooms and offices.

The four additional all-electric schools in the planning stage are in Bellevue, Bothell and Mercer Island.

► **Packard Bell Electronics** has appointed **Jack Houseman** southern California district sales manager, Home Products Division, a new position. He joined the company two years ago as assistant to Robert H. Thompson, sales manager. Headquarers are in Los Angeles.

► **Graybar** has been appointed distributor for **Hoffman** TV, stereo, hi fi and radio in San Diego and Imperial Counties of southern California. The company already distributes the Hoffman line in six southern and Western states. The new territory will be administered by Graybar's San Diego branch, managed by **R. T. Redfield. Dale Matheny** will be Hoffman specialist.

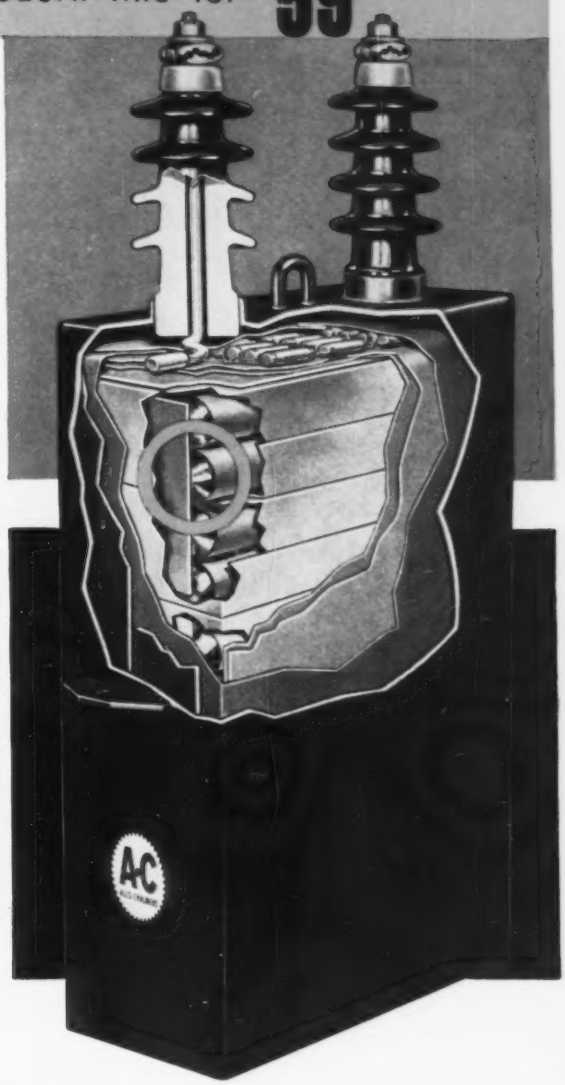
► Wrapping up a successful campaign, **Hotpoint** sent 160 Los Angeles area dealers to Hawaii on Sept. 15. The dealers qualified for the 10-day vacation by meeting or passing standard quotas on Hotpoint's entire commodity line during the March 2 to Aug. 21 run of the campaign. The Hawaiian junket marks the fifth such major trip sponsored by Hotpoint since 1956.

(Continued on p 116)

ALLIS-CHALMERS modern line for '59

EXTENDED-FOIL COOLING...

- reduces hot-spot temperatures
- lengthens service life



New Allis-Chalmers Power-Factor Capacitors

Allis-Chalmers extends aluminum foil *beyond* the ends of each capacitor pack to speed heat dissipation to container sides. Result: *substantial reduction* in hot-spot temperature over ordinary capacitor designs!

And electrical contact is also improved. Broad spring-pressure contact plates press against the long edges of each foil. Losses are minimized; low current density results. Your bonus: extra years of faithful capacitor life . . . extra protection against transient overcurrent induced by lightning, switching surges or capacitor-discharge through nearby line faults.

Capacitor Facts Fast! Call, wire or write...

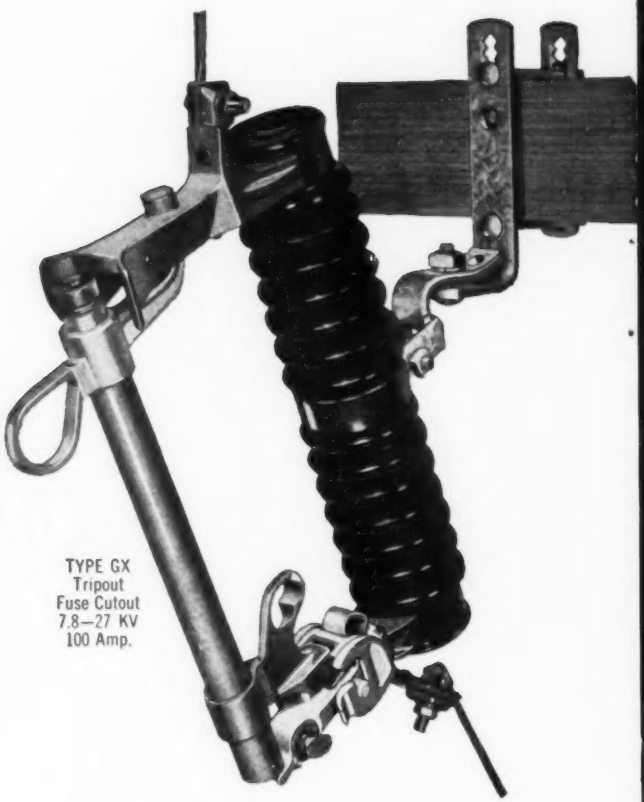
ALLIS-CHALMERS A-C

A-1188-E

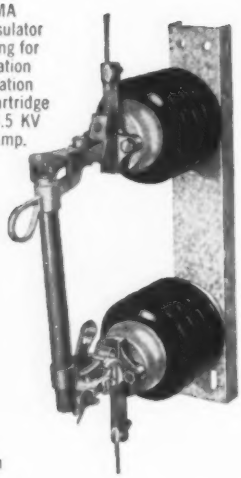
For phone number of closest representative see advertising index in back of book.

KEARNEY

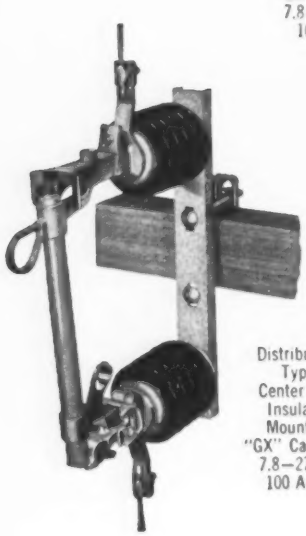
KEARNEY "G" and "GX"



TYPE GX
Tripout
Fuse Cutout
7.8—27 KV
100 Amp.

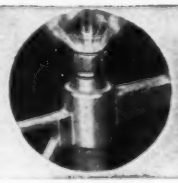


NEMA
Post Insulator
Mounting for
Substation
Installation
"GX" Cartridge
7.8—34.5 KV
100 Amp.



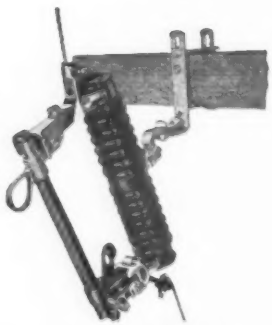
Distribution
Type
Center Bolt
Insulator
Mounting
"GX" Cartridge
7.8—27 KV
100 Amp.

Type "GX" Cartridges vent at bottom only on low-amperage faults . . . at both ends on high fault currents. Both vents are in line with axis of tube, reducing shock recoil to a minimum. On high amperage faults, top venting action blows small disk out of expendable cap to safely relieve gas pressure.

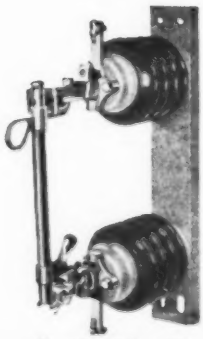


UPDATE YOUR OLDER CUTOUTS WITH KEARNEY CONVERSION UNITS

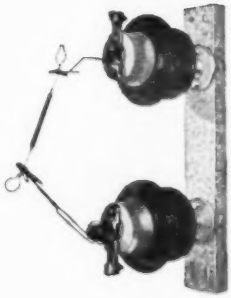
These modern current-carrying parts install on existing mountings to give you all of the outstanding features and performance of the newest Kearney Cutouts—positive dropout action, higher interrupting capacity, and extra strength fuse tubes.



Type G 5.2-15 KV
Type GX 7.8-15 KV



Type G and Type GX
7.8-34.5 KV



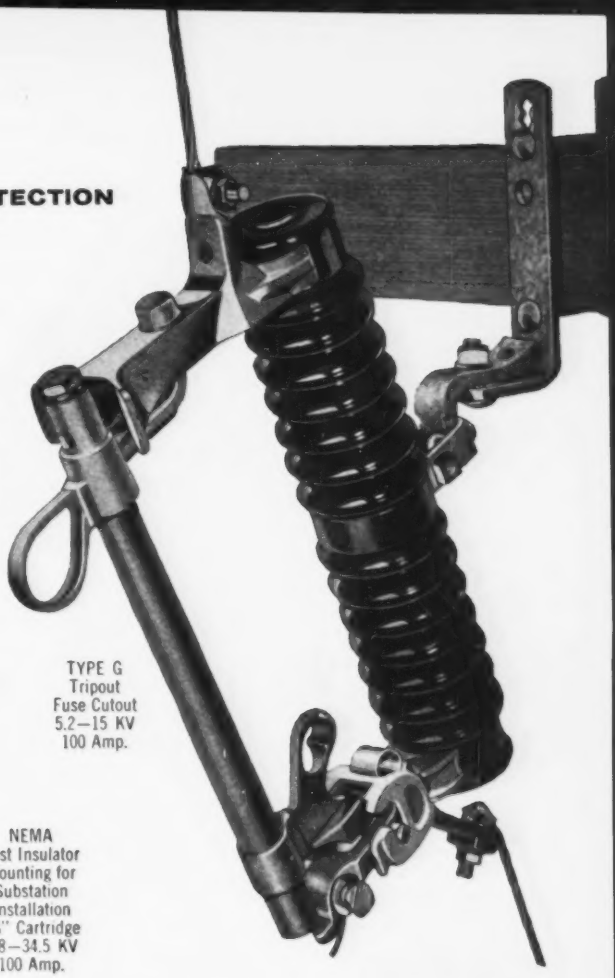
Trip-O-Link 50 Amp.
23-69 KV

for better construction – safer maintenance – specify KEARNEY products

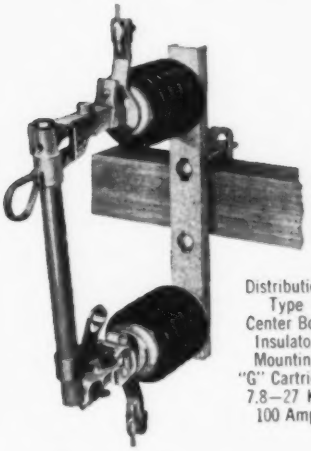
cutouts...

FOR DEPENDABLE, MODERN SYSTEM PROTECTION

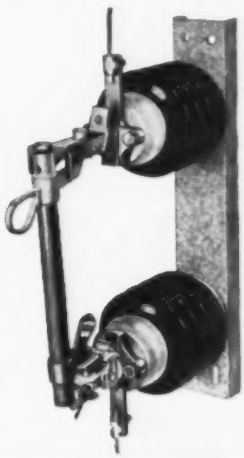
Kearney Type "G" and "GX" Tripouts assure the highest level of operating dependability and economy for full range distribution system protection. Both interrupt fault currents ranging from minimum melting of the link to maximum rating of the cutout with any size button head link up to 100 amperes. A choice of venting is offered by two cartridge types, interchangeable in the same voltage ratings. Full-time double venting is provided by the "G"... and pressure-controlled double venting by the "GX." These two cartridges, and a wide range of interrupting ratings, voltages and mountings meet every operating requirement.



TYPE G
Tripout
Fuse Cutout
5.2—15 KV
100 Amp.



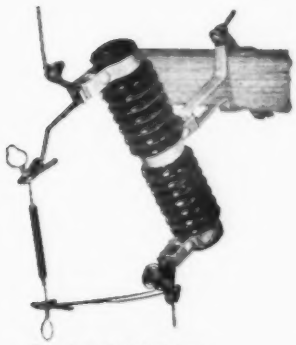
Distribution
Type
Center Bolt
Insulator
Mounting
"G" Cartridge
7.8—27 KV
100 Amp.



NEMA
Post Insulator
Mounting for
Substation
Installation
"G" Cartridge
7.8—34.5 KV
100 Amp.

Front vent directs expulsion gases away from line equipment. Gas pressure from top jet keeps cartridge in place and upper contacts closed until arc is extinguished. Size of top vent in double vented cartridge allows build-up of ample pressure to extinguish low amperage arcs, yet enables cartridge to withstand gas force of high current faults without rupturing.

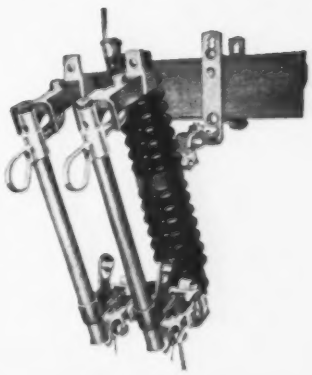
Heart of Type "G" construction is this full-floating constantly aligned upper contact, which cannot be misaligned by high current interruption or extreme side thrust during closing. During interruption, force of cartridge thrust is absorbed by full-floating contact until arc is extinguished and cartridge drops out.



Trip-O-Link 50-100 Amp.
5.2-15 KV

KEARNEY DUAL CARTRIDGE LOAD INTERRUPTER

Safe, positive way to interrupt load current. For full load sectionalizing or dropping transformer or capacitor banks. Current is interrupted electrically, not mechanically. During operation, one cartridge, fused for load protection, is closed in; the other, the interrupter, fused with a low amperage link, remains open. Later this cartridge is closed in, and service cartridge pulled out. After predetermined time delay, small link blows, interrupting current safely within interrupter cartridge.



JAMES R. KEARNEY CORPORATION

GENERAL OFFICES: 4224-42 CLAYTON AVE. • ST. LOUIS 10, MISSOURI

IN THE WEST: for prompt service, contact Kearney's West Coast Distributor, Maydwell and Hartzell, Inc., Los Angeles • Seattle • Portland • San Francisco • Spokane • Phoenix

***Plants at:* ST. LOUIS • FAYETTEVILLE, ARKANSAS • SHENANDOAH & CLARINDA, IOWA • GUELPH, ONTARIO, CANADA**

Kitchen in the Home-Orama's Gold Medallion, Pagoda Charm, featured built-ins. Heating and air conditioning is by heat pump. Lighting, an integral part of the decoration, utilizes a valance supplemented by oriental lamps. Calectric and Edison were sponsors

Medallion Homes Feature At Show

Feature attractions at this year's Home-Orama in the San Bernardino area of southern California were four Medallion Homes, one of them gold.

Sponsored by the Home Builders Assn. of San Bernardino and Riverside Counties, the show is used as a showcase by builders, manufacturers, subcontractors and other suppliers.

The nine model homes in the show were viewed by 65,000 people during a 16-day run.

California Electric Power Co. and Southern California Edison participated in promotion of the Medallion Homes, built by I. C. Minium and J. and K. Mack Studios; E. J. Miller; Ray Staff; and Gordon Fields.

Although advertising and publicity for Home-Orama were limited to straight show promotion, easels in front of each house carried contributor credits and specified which were Medallion Homes. Builder representatives in the Medallion Homes reported that they were under a constant barrage of questions about the electrical living concept that qualified a house for a Medallion award.

Calectric said it was initiating a special program of salesman indoctrination for use by builders throughout its service area. "We have experimented with talks on 'How to Sell a Medallion Home' with several builders. Now, as a result of those tests and the inquiring public mind demonstrated at Home-Orama, we will launch an orientation program for men and women who will be selling Medallion Homes for the builders," the company announced.

► EEI has made available a five-part **electric appliance sales training course.** Included is a section on basic selling principles reviewing basic tenets of salesmanship presented in a previous course. Other sections deal with selling the electric range, dryer, water heater and refrigerator-freezer. The course may be secured for $99.50 from the Sales Division of Edison Electric Institute, 750 Third Ave., New York 17.

► **Hoffman Electronics** has appointed **Thomas Lowey** to the newly created post of advertising and sales promotion director, Consumer Products Division.

► **Extension of its automatic clothes dryer warranty** from one to five years was announced last month by the Norge Division of Borg-Warner Corp. The new warranty applies to all parts except the motor.

Prospects for Medallions

With many utilities ahead of schedule, the West continues to lead in the Medallion Home promotion, according to Frank Falge, Western regional manager, Live Better Electrically.

If 1960 objectives are met (62,800 medallions, 23% of new homes), sales of appliances and lighting and wiring equipment in the West would be increased by $68,720,000. Electrical power sales would be up by 55 billion kwh.

► **Arc Electric Co.,** one of the most complete and well-managed contractor-dealer businesses in the San Francisco Bay region, has opened a peninsula division which will be operated independently, according to Guido Menacucci, president.

San Diego Show Will Be 26th Annual

San Diego Bureau of Home Appliances will sponsor its 26th annual Electrical & Home Appliance Show in the Electric Building, Balboa Park, from Nov. 27 to Dec. 2.

All major and small appliances, lighting and wiring equipment, hobby tools, radio, TV and stereo equipment will be displayed, according to J. Clark Chamberlain, secretary-manager. He predicted 200,000 will attend.

Christmas Tree Lane and pre-Christmas ceremonies will coincide with opening of the show.

► **Fred J. Bertolone, Curtis-All-Brite** district sales manager, has announced staff changes: **W. E. "Bill" Eliot,** who has been sales engineer in Alameda and Contra Costa Counties of California, is being transferred to San Francisco, where he will handle all distributor and contractor accounts. **Alon D. Montgomery** will cover engineering and architectural accounts in San Francisco, replacing John MacDonald, resigned. **E. B. "Ed" Mattos** has joined the organization as sales engineer to succeed Eliot.

► **In Washington Water Power** territory it is reported that the distributor has already moved a couple of hundred of the automatic friendship yard lights. The public is being informed principally through door knob hangers left by meter readers. The offer is made on a basis of $67.50 installed.

"light ideas"

..from virden

to add plus profits to your fixture sales

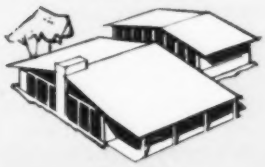
For Traditional Homes

V-1476 One of six gorgeously styled Colonial chandeliers. Handcut crystal and gleaming brass to add a brilliant touch to any room.

V-6051 Authentic Early American in a pulldown. Polished brass with white shade. Opal chimney has star decorations.

V-1499 Quiet dignity, warm hospitality is exemplified in this traditional design. In 6, 4, 3, and 2-light models, each handfashioned from solid brass.

For Contemporary Homes



V-1193 An unusually versatile 3-light cluster . . . use it in living rooms, dining areas, family rooms, anywhere you need a smart modern accent.

V-1630 Modern blending of white imported plastic and polished brass, an exciting accent wherever it is used.

V-6200 Perforated downlight with crystal lens. Polished brass. Excellent accent light.

V-4465 Gleaming brass and satin white, in a modern blending.

V-7940 Give your patios, porches, entranceways extra sales appeal with this outdoor wall lantern.

For Transitional Homes

V-1791 The lovely charm of polished copper and black in the popular pulldown style.

V-1860 A touch of brilliance in an exciting 6-light chandelier. Use it with matching ceiling and wall lamps for a wonderful effect.

V-6840 Add a touch of glamour with this bathroom fixture. Use it singly or in pairs.

V-5880 Lift your halls and entryways out of the ordinary with this graceful design. Has matching wall unit and 5-light chandelier.

V-3920 Give your bedroom the look of richness. Imported glass has crystal beads, polished brass trim.

Your Virden distributor has the complete line of Virden "light idea" fixtures on display now.

Find It Fast In The Yellow Pages

VIRDEN Lighting

virden LIGHTING

A Division of the John C. Virden Company
Cleveland 3, Ohio
Member American Home Lighting Institute
In Canada, John C. Virden, Ltd., Toronto, Ontario

For phone number of closest representative see advertising index in back of book.

Ventilate and Heat
that manhole
Safely
with a
MODEL PE
UL listed
MO PE CO
propane
VENTILATING HEATER
Fresh Air... heated fresh air in one portable unit!
• Weighs only 62 pounds
• 300 to 800 cfm fresh air
• 10° to 96° temperature rise
• Propane or Butane fuel
• 10' L.P.G. hose standard
• Safe fresh air blown into manhole at all times.
• Eliminates manhole explosion and oxygen deficiency accidents.
Order through your favorite distributor.
WRITE FOR ILLUSTRATED BROCHURE SHOWING ALL MoPeCo MODELS.
Write or Call
MORRISON-PELSUE COMPANY
2001 South Bannock Street • Race 2-0234 • Denver 23 Colorado

Keeping line clearance costs DOWN
goodwill UP
Proven power equipment and Davey trained rope climbers... that's what makes Davey Surgical Line Clearance so economical. Utilities can rely on the dependable, efficient, and *adaptable* Davey crew. It will pay you to talk over your tree maintenance problems with the West's leading line clearing specialists—Call Davey.
DAVEY
TREE SURGERY CO., LTD.
OF CALIFORNIA
SAN FRANCISCO • Russ Building
LOS ANGELES • Story Building
DAVEY
PRESERVES
TREES

Knoll Estates Go Total Electric

First model homes in the West incorporating the Westinghouse Total Electric Home concept were opened for inspection Sept. 13 at Oak Knoll Estates, south of Santa Maria, Calif.

Built by the Atlantic & Pacific Building Corp., the two model homes will be open daily from 10 a.m. to 9 p.m. for six weeks. Thelma Fahrenkrog, Pacific Gas and Electric Co. home economist, will demonstrate all-electric kitchen features.

According to J. G. McKinley, manager of the Total Electric Home department for the Westinghouse Pacific Coast region, the Oak Knoll development is one of seven erected in the United States to show that electric living is adaptable to any geographic location or price range.

Full housepower provides wiring for present and future appliances. Lighting is planned to enhance home furnishings and to give eye comfort as well as eye appeal.

Plans call for a minimum of 90 Total Electric Homes in the Oak Knoll Estates, a walled-in community that will include a school, shopping center and churches.

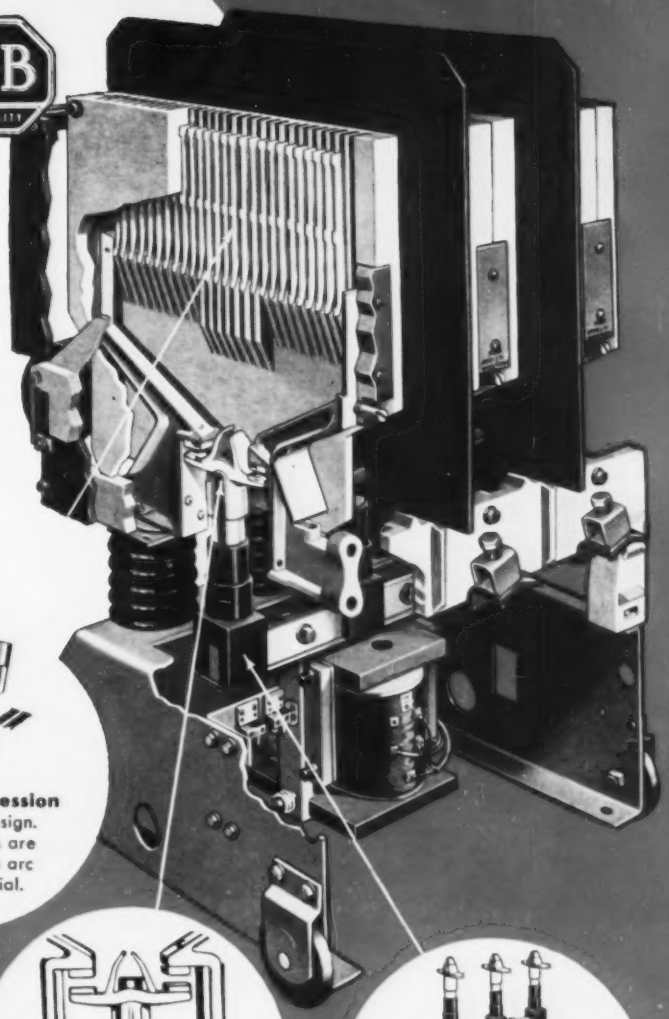
► **Ralph Zeuthen** has been appointed program manager for the **Live Better Electrically Program** of the Edison Electric Institute. For the past two years he has been president of Zeuthen, Thomas & Hulbert, Minneapolis advertising agency. Previously he had been with Campbell-Mithun, handling public relations and supervising accounts that included Northern States Power Co.'s housepower promotion.

► **Home Laundering Terms,** a 24-page dictionary prepared by AHLMA, is designed for use in instructing consumers, colleges and high schools; in advertising and promotional copy; in publications and within the industry. Copies are available at 10¢ each from American Home Laundry Manufacturers' Assn., 20 N. Wacker Drive, Chicago 6.

► A feature of **Public Service of Colorado's new Denver service** center is an electric service department and appliance repair shop. With a staff of 50, the department has at its disposal 18 two-way radio-equipped trucks, which can be dispersed at a moment's notice to the customer's premises.

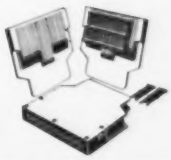
Here's the inside story of industry's

MOST RUGGED HIGH VOLTAGE SWITCH



THIS SOLENOID AIR BREAK CONTACTOR IS THE HEART OF THE A-B STARTER LINE

A tremendous operating life has been built into these new A-B high voltage, air break starters by using the same simple solenoid design—with only ONE moving part—that has proved good for millions of trouble free operations in Allen-Bradley low voltage starters. A-B high voltage starters are made for all types of service and for all types of motors up to 1500 hp, 2300 v; 2500 hp, 4600 v. Send for Publication 6080, today.

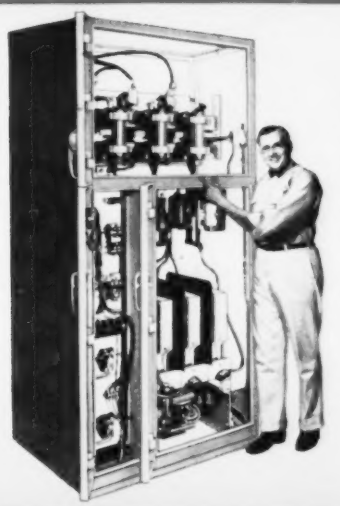


Faster Arc Suppression
New blowout design. Novel arc chutes are molded from an arc resistant material.

Double Break Contacts
Silver alloy contacts never need maintenance. Vertical motion assures uniform contact pressures.

Only One Moving Part
Simple solenoid design eliminates trouble-causing pins, pivots, and flexible jumpers.

8-29-RM



A-B High Voltage Starter with Air Break Contactor

Bulletin 1159 high voltage air break, across-the-line induction motor starter in NEMA Type 1 enclosure. All Allen-Bradley high voltage starters are equipped with current limiting fuses with interrupting capacities of 150,000 kva at 2300 v; 250,000 kva at 4600 v.

ALLEN-BRADLEY

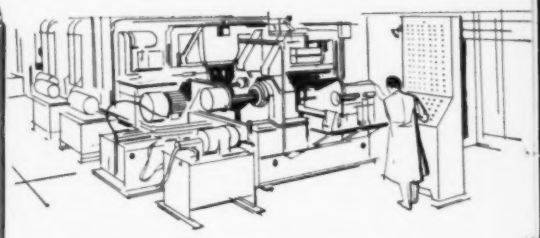
Member of NEMA

Quality Motor Control

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

AUTOMATION BEGINS HERE

. . . Insist on Allen-Bradley accessories for continuous automatic production



In this broad line of Allen-Bradley accessories, each and every unit carries the traditional A-B trademark of *quality* that stands for trouble free operation. Rugged construction, and maintenance free, silver alloy contacts provide the reliability that is essential to the continuous operation of *your* automatic production machines.

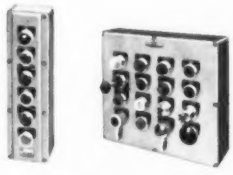
Profit from the experience of the leading machine tool builders . . . insist on Allen-Bradley *quality* motor control *all the way!*

▲ Special push button panels can be assembled to your specifications.

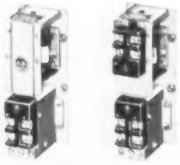
OILTIGHT LIMIT SWITCHES
Bulletin 802T with sealed heads and bodies. Various operators.

PRECISION LIMIT SWITCH
Bulletin 802 oiltight. Responds to very small operator travel.

OILTIGHT CONTROL UNITS
Bulletin 800T. Choice of push buttons, lights, and switches.



OILTIGHT CONTROL STATIONS
Bulletin 800T for up to 16 units in die cast aluminum enclosure.



PNEUMATIC TIMERS
Bulletin 849. Reliable and accurate. For on-delay or off-delay.

OILTIGHT PRESSURE CONTROL
Bulletin 836. For hydraulic systems with pressures to 5000 psi.

STANDARD DUTY PUSH BUTTONS
Bulletin 800. Up to three units, also pilot lights and switches.

FOOT SWITCH
Bulletin 805. In rugged die cast housing for toughest service.

8-59-RM

ALLEN-BRADLEY

Member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

QUALITY MOTOR CONTROL

Mrs. Evelyn Conant, director of home economics for Southern California Edison Co., points out one of the features of an electric washer to six college students participating in Edison's summer home economists' training program. The trainees—all home ec majors—are Kathleen Feeley, Mount St. Mary's College; Nancy Harmon, UCLA; Frances Ann O'Connor, UCLA; Sally McClellan, Los Angeles State College; Frances Preece, Whittier College; and Mary Ellis, San Jose State College. (See EWest, August, p 120)

► New officers of the Kitchen Division of the San Diego Bureau of Home Appliances: **Worth Pollard,** California Electric Works, chairman; **Gordon Hillhouse,** Howard Palmer Builders Hardware, vice-chairman. Members of the executive committee are: **Wayne Butt,** Aztec Screen & Cabinet; **Einer May,** Montgomery Ward & Co.; **Reg Payne,** La Jolla Appliance Co. Committee chairmen for next year are: **Gene Hanna,** 1960 Parade of Kitchens; **Bill Finley,** Seal of Approval; **Bill Durning,** Education. **Bob Gray,** St. Charles Kitchen Designers, is immediate past chairman; **Jim Hardin,** San Diego Gas & Electric Co., is coordinator.

► R. E. Harris Inc., San Diego Philco distributor, has moved to a new building at 820 W. F St. They were officially "at home" in the large new quarters on Sept. 4.

► **Moe Levin** of M. Levin Co., Portland, attended a recent sales meeting of **Eagle Electric** Mfg. Co. representatives at the firm's plant No. 5 in Long Island City, N. Y.

Fashions in Food

More than 1,500 women in the Phoenix area saw this production by Arizona Public Service Co. and Phoenix Newspapers Inc. Utility home service advisors used the theme My Fair Lady to demonstrate cooking techniques and recipes

ONLY EDWARDS MAKES A COMPLETE LINE of signaling products for control, communication and protection.

SOLD ONLY THROUGH ELECTRICAL DISTRIBUTORS (with these complete sales programs from Edwards for their use)*
- "sound partnership program"
- "industrial modernization"
- "product information"

(*endorsed and supported by national and regional distributor and contractor associations)

INSTALLED BY ELECTRICAL CONTRACTORS who prefer Edwards 4 to 1 for simplicity and quality that means quicker installations, no callbacks.

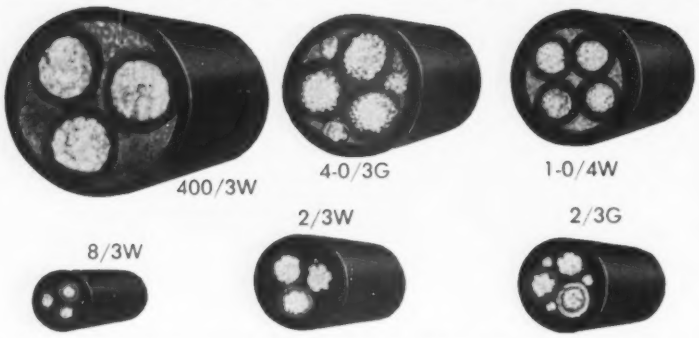
BACKED-UP BY EDWARDS TECHNICAL SPECIALISTS in 58 cities who work with distributor, contractor, architect and engineer.

TEAM-UP WITH EDWARDS Ask your local Edwards representative how modern signaling (clock systems, fire alarms, drop and lamp annunciators, audible signals, etc.) can benefit you, or write Edwards Company, Inc., Norwalk, Connecticut. (In Canada: Edwards of Canada, Ltd, Owen Sound, Ontario.)

DO BUSINESS WITH THE TEAM THAT'S SETTING RECORDS

EDWARDS

HEAVY DUTY POWER CABLE



COMPLETE RANGE OF SIZES FOR ALL FLEXIBLE POWER CABLE REQUIREMENTS

Plus

• West's largest inventory of heavy duty and high voltage cable • multiple conductor control cable • flexible cords and cable

WC

WILLIAM CERESKE company

electric wire and cable

Phone TEmplebar 2-3546 (Oakland) and ask for "Scotty". Name your size and length, we ship today. Iron-clad guarantee of quality. Write for current listing of sizes and specifications.

1401 MIDDLE HARBOR ROAD OAKLAND 20, CALIFORNIA TEmplebar 2-3546

They both know the best buy in tape...

ACCURATE TAPES

FRICTION.... RUBBER.... PLASTIC

Send today for our most recent bulletin describing details.

ACCURATE MANUFACTURING COMPANY

GARFIELD, NEW JERSEY

Farms Hooked Up

The Alberta government reports that electricity has been extended to almost 75% of Alberta's 63,500 occupied farms and that this percentage is expected to increase to 85% by 1960.

The report stated that more than 1,200 farms have been hooked up so far this year and that another 1,800 will receive service by the end of December.

In reference to service for 85% of the farms by 1960, the report said that "this is judged to be an economic maximum of service."

A total of $26,112,021.50 has been loaned under the provincial government's Rural Electrification Revolving Fund since inception of the assistance program in 1953.

► One of the highlights of the **1959 Home Show in Los Angeles** was the Department of Water & Power display of an electric heat pump. The transparent display showed graphically how the heat pump operates in heating, cooling, filtering and dehumidifying. The department reported that considerable interest was shown not only by homeowners but also by engineers, architects, designers, contractors and others in the building trades.

► Hamilton Mfg. Co. has established a branch office in the Los Angeles Home Furnishings Mart, to cover sales and service throughout southern California, Arizona and southern Nevada. **John Wicht,** formerly vice-president and general manager of Blackstone's laundry equipment division, is the manager of the new branch operation.

► A new NARDA chapter—first in the area — has been formed by **12 Los Angeles merchants,** members of United Stores Inc. The local organization was formed through efforts of three NARDA members among United dealers, Cliff Swanson, Studio City; L. C. Pemberton, Washer Wilson, Los Angeles; Mil Zillgitt, Inglewood.

► During the remaining months of 1959 **Whirlpool Corp.** will discontinue distribution of sinks and kitchen cabinets and will concentrate on appliances manufactured in its own plant, according to C. A. Reinbolt Jr., general manager of specialty products. Although Whirlpool offered its distributors a full line of sinks, steel cabinets and steel cabinets with interchangeable wood fronts, it did not manufacture these units.

Manufacturers—Distributors

► **I-T-E Circuit Breaker** Co. has set up a new position — national sales specialist for outdoor power circuit breakers made by its Los Angeles Kelman Division — and has named **Maxwell L. Stoughton** to the post. He will assist in the marketing of Kelman breakers to utilities and industry on a nation-wide basis. After training at the Kelman plant, he will be attached to the office of E. A. Schmidt, I-T-E commercial vice-president. Stoughton formerly was manager of the company's Philadelphia district office.

Stoughton

► Promotion of **F. E. Leib** to the post of vice-president in charge of Copperweld's Wire and Cable Division has been announced by James M. Darbaker, president. Leib, who succeeds the late William W. Ege, previously was general manager of sales.

► Name of the **Jack Payne Co.** Inc., Los Angeles manufacturers' representative, has been changed to **Payne & Sloan** Inc., with **George R. Sloan** becoming a 50% partner in the firm. Sloan had been a salesman with the company for the past 2½ years. Among the lines handled by Payne & Sloan are Carol Cable Co., Fullman Mfg. Co., Slater Electric & Mfg., Federal Sign & Signal Corp.

► **Canadian Western Pipe Mills** Ltd., operating a $6 million plant at Port Moody, B. C., is now manufacturing galvanized electric conduit. It is the first Canadian conduit manufacturer to carry out the full process, from the tubing to the finished conduit. According to Ralph C. Wiesinger, executive vice-president, the conduit is produced in diameters ranging from 1 in. to 4½ in. and production of 150 tons a month is planned. Canadian Western Pipe Mills, a subsidiary of the German Phoenix-Rheinrohr, began production in British Columbia in 1955 when Canada's productive capacity for pipe was 500,000 tons a year. Present Canadian capacity is 1,400,000 tons a year.

TRY THIS ON THE SALES DEPT.

That fez is an automatic light switch with a circuit not unlike the Fisher-Pierce 6600A streetlighting control — tubeless, CdS cell, relay. But this "Nitelighter®" is for indoor use, to sit near a window and turn on a lamp or two (up to 300 watts total) when it gets dark or dreary outside. Although turn-on and turn-off are completely automatic, you can switch the lamp on and off yourself if you want to, with two push buttons that operate the relays and give the device a "memory." That way you don't have to remember which button you pushed last — the lamp always automatically goes back to its on-at-dusk, off-at-dawn routine.

If the name "Nitelighter" sounds familiar, you're thinking of the daddy of this brand new one. Though nowhere near as smart as this one, it sold by the thousands in stores and retail outlets of utilities. People bought them for lots of reasons — just plain gadget appeal, to fool burglars into thinking they were home when they weren't, and simply because they disliked coming home to a pitch-black house at night. As a matter of fact, we've used the Nitelighter extensively in getting the bugs out of the original 6600 photoelectric streetlighting control design and for testing various types of photocells (about 5 or 6 years ago).

Judging by the reception the first Nitelighter got, we're hoping that demand for the new one ($17.95 list) will keep us hopping. The man in charge is Frank Mead, and he'd like nothing better than to tell your sales dept. all about it. Write him at The Fisher-Pierce Co., 43 Pearl Street, So. Braintree 85, Massachusetts.

FP

FISHER PIERCE

PHOTOELECTRIC LIGHTING CONTROLS

AN AFFILIATE OF SIGMA INSTRUMENTS, INC.

This Kaiser Aluminum conduit demonstration and display van, one of five, is shown in Oakland, Calif., during a "shakedown" demonstration for company executives. Forrest Shrider (kneeling) bends aluminum conduit of large diameter. Watching him are Harry Sugar, president and chairman of Alsco Inc., and D. A. Rhoades, president, Kaiser Aluminum & Chemical Corp. (on van platform); Fred J. Drewes, administrative manager; Kaiser Aluminum Vice-presidents John E. Menz, Thomas K. McCarthy and Thomas J. Ready Jr. Shrider will give demonstrations before electrical distributors, contractors and other interested groups throughout the West. Building in background is Kaiser Center, nearing completion in Oakland

► **The Kenneth B. Schumann** Co. of Denver will represent **Clayton Mark's Conduit Division** in Colorado, Wyoming and Utah. The 15-year-old firm will supply thin wall steel conduit and rigid conduit. Headquarters will be at 1073 Galapago St., Denver.

► **Pacific Electric Motor** Co. has been named an approved service shop for Allis-Chalmers' Silco-Flex insulated motor rewinds. Pacific Electric is located at 1009 66th Ave., Oakland, and 610 W. 10th St., Pittsburg, Calif.

G-E Drops Prices

The General Electric Co. on Sept. 24 announced a revolutionary new program in the design and manufacture of power transformers, which it believes will help electric utilities in their long-range fight against inflation.

Effective Sept. 28, the program provides an average reduction in published prices of more than 5% for the entire line of power transformers.

The new program, called "preferred design," applies to all power transformers. Previously, preferred design was applied only in the manufacture of much smaller power transformers.

Basically, preferred design cuts costs by manufacturing transformers that have a uniform exterior design, thus permitting mechanized production line techniques with attendant economics that offset inflationary tendencies caused by ever-rising labor and material costs.

Coupled with a giant 705 computer that automates much of the routine electrical calculations, the preferred design transformers likewise offers other immediate benefits, such as improved delivery schedules, faster substation design construction, easier installation and maintenance resulting from uniform mechanical features and accessories.

► **J. W. Mahoney** has been named vice-president-Western region by **H. K. Porter** Co. and will headquarter at 6400 Corvette St., Los Angeles, it was announced by C. L. Holbert, president. Mahoney joins Porter after 13 years of sales and executive experience with Phillips Petroleum Co. and eight years with Gladding, McBean & Co., where he served as executive vice-president. He was a naval officer in the Pacific theater during World War II.

► Cancellation of the announced sale of **Pacific Electrichord** Co. and **Coast Cable** Inc. to a New York holding company has been announced by Arnold Schott, president of the two electrical firms. Schott has re-acquired all interest in these companies from the holding company, Essex Universal Corp. Pacific Electrichord and Coast Cable make electric chord sets, wire and cable, and electrical wiring devices.

FPE Sets Up Service Centers

In a functional reorganization, Federal Pacific Electric Co. has converted nine of its regional manufacturing plants to self-contained customer service centers offering integrated production, engineering, sales and distribution services. Centers in the West are at Seattle and Los Angeles.

Joseph H. Schlessel, general manager of the new Customer Service Center Division, said that Federal Pacific is trying to "marry local requirements and national company advantages"; that centers stocking standardized mass-produced components can supply most custom panelboard needs on a 24- to 72-hour shipment basis. He stated that the company will open additional centers as specific markets require them.

► **Jack G. Anderson** has been appointed to the new position of vice-president-marketing for **Hoffman Laboratories Division,** Hoffman Electronics Corp. He joined Hoffman in 1954 as assistant manager at Dayton, Ohio, became manager of that office in 1956 and in 1958 was transferred to Los Angeles to head military sales activities.

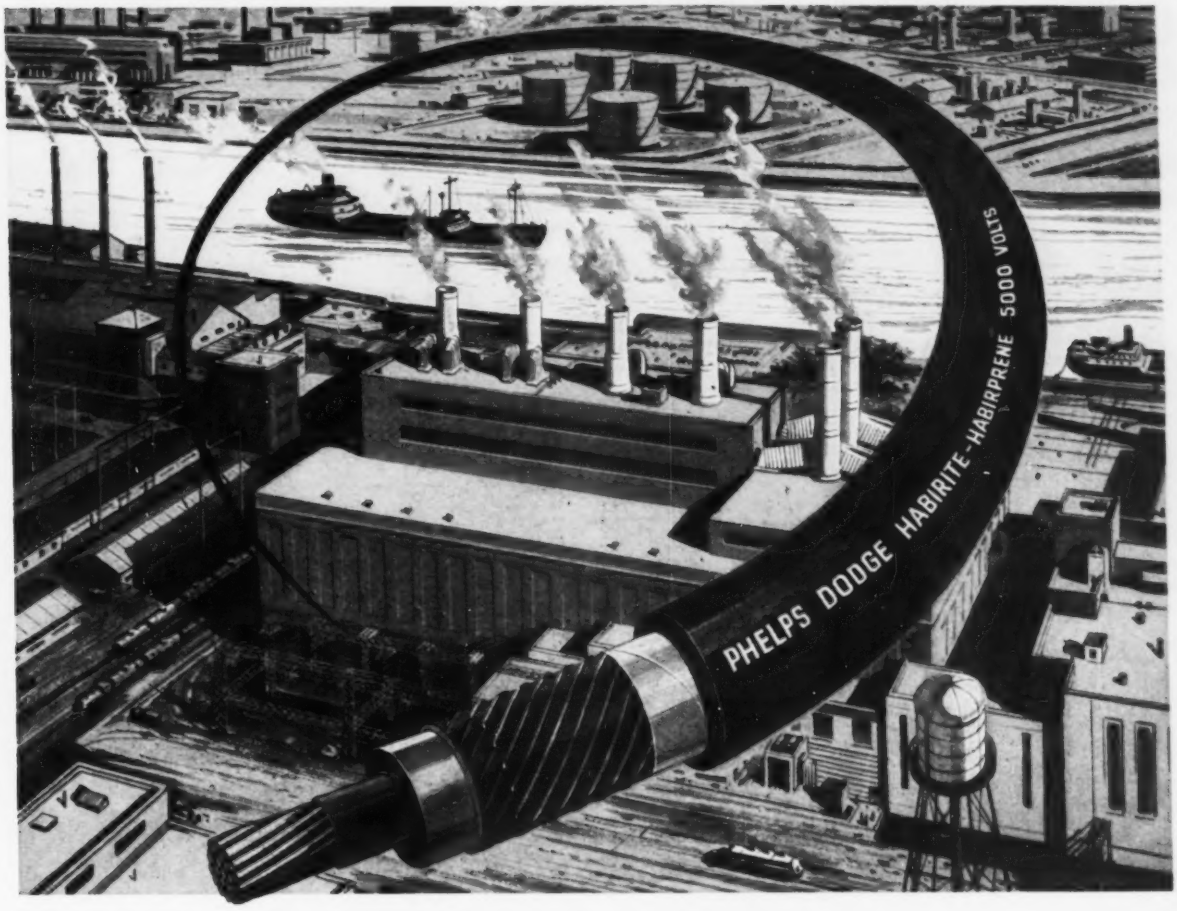
Anderson

► **Packard Bell Electronics,** Service Division, has appointed **Charles D. Ebert** as director of marketing for the industrial products department. He will direct sales of closed-circuit television cameras and systems for industrial, institutional and educational applications. He formerly was with C. G. Hokanson and Holmes Tuttle Lincoln-Mercury.

Ebert

► **Allis-Chalmers** has appointed **Power Transmission Co.** of Denver as distributor of its motors in Colorado. Located at 4965 Jackson St., Power Transmission is headed by **J. R. Torpey.**

WHEN ORDERING "TYPE RR" CABLE...



SPECIFY HABIRITE-HABIRPRENE

The high voltage cable that assures superior quality and service reliability!

The term "RR" is only a name, not an assurance of quality. Instead of ordering just "RR" cable, insist on Phelps Dodge *Habirite-Habirprene*—developed through years of experience in designing and manufacturing this type of cable.

Phelps Dodge Habirite insulation, a specially engineered butyl rubber compound, has a service dependability record unsurpassed by other types of rubber insulation. Habirite is greatly superior to old-fashioned insulation for these reasons:

- Much greater resistance to heat and oxidation which permits a higher temperature rating, with consequent reduction in conductor size and in cost for same current load.
- Much greater resistance to ozone usually present around high voltage equipment.
- Better electrical properties that give a greater safety factor in operation.

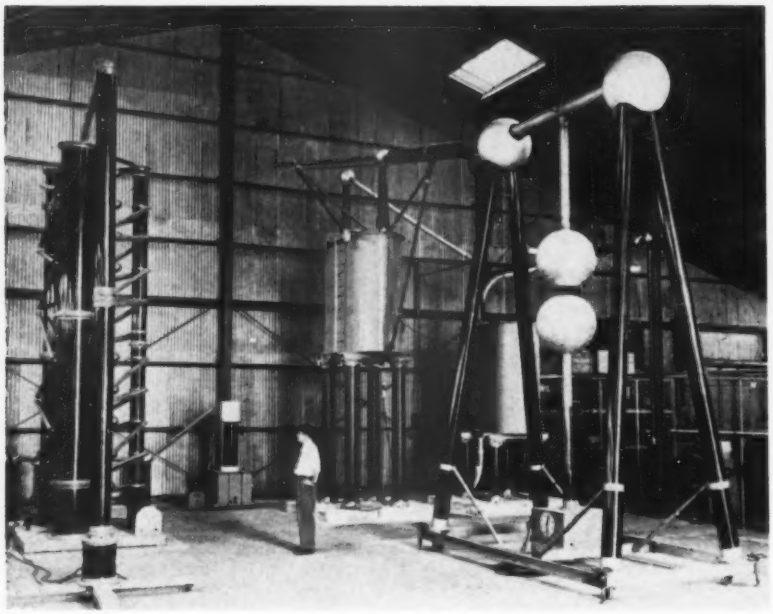
Phelps Dodge Habirprene sheath, a neoprene compound with improved mechanical toughness against damage from installation hazards, is especially made to be extra resistant to corona, one of the worst enemies of high voltage cable. This extra resistance provides a greater safety factor in operation and has contributed to the remarkable reputation and service record of *Habirite-Habirprene*.

When you specify *Habirite-Habirprene*, you are assured of high voltage cable with the utmost in safety and durability. *See your Phelps Dodge Distributor!*

PHELPS DODGE COPPER PRODUCTS CORPORATION

P D

SALES OFFICES: Atlanta, Birmingham, Ala., Cambridge, Mass., Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Dayton, Denver, Detroit, Fort Wayne, Greensboro, N. C., Houston, Indianapolis, Jacksonville, Kansas City, Mo., Los Angeles, Memphis, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochester, N. Y., San Francisco, St. Louis, Seattle, Washington, D. C.



Test equipment in new Kelman Laboratory includes 1,500,000-v surge generator (left), which duplicates effects of lightning; high voltage transformer supply, consisting of two units which can provide a combined output of 666,000 v; and sphere gap stand (right)

New High Voltage Lab At Los Angeles

A high-voltage development laboratory put in operation by I-T-E at its Kelman Power Circuit Breaker Division, Los Angeles, is one of the largest of its kind on the West Coast. The new facility, capable of surge testing to voltages as high as 1,500,000 v, also incorporates the only high-current testing setup on the West Coast.

It will provide a key testing tool for development of new and improved products in its line of power circuit breakers and will be available to regional utilities and industrial firms for advanced testing of a wide range of materials and components, the company said in its announcement.

The Kelman breaker line ranges in voltage from 14,400 v through 230,000 v and in interrupting ratings from 100 mva to 15,000 mva.

The new laboratory will decrease the time required for research and testing from the development stage to actual production and will permit acceleration of general studies of parts, components and materials at higher voltages, the company stated.

Facilities also will provide the foundation for future studies at even higher voltages, to keep pace with the mushrooming trend toward higher voltages by electrical utilities throughout the country, it said.

Principal items of equipment at the new Kelman lab include test sets purchased from testing laboratories, now disbanded, at Pacific Oerlikon Co., Tacoma, Wash., and at the California Institute of Technology, Los Angeles. They include equipments for these tests:

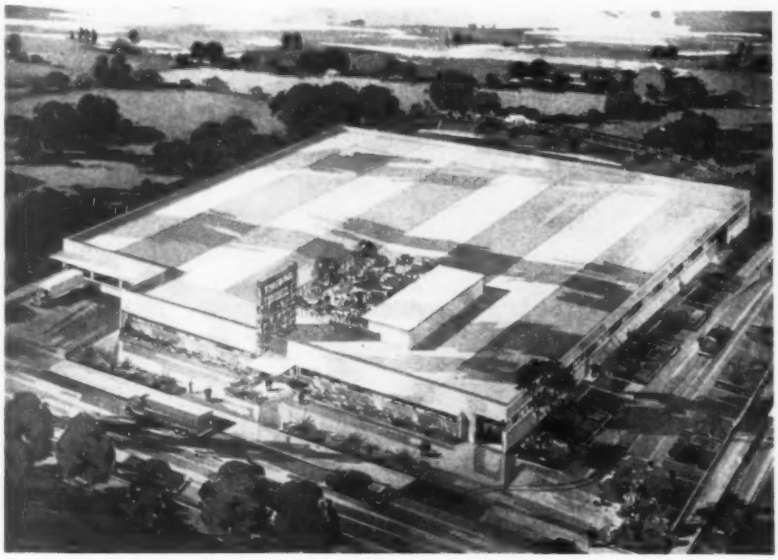
1. High voltage power frequency. This facility consists of two transformer units, each producing 333,000 v, connected in cascade to provide a total of 666,000 v. Input voltage to the transformer equipment is 480 v at 60 cycles.

2. High voltage impulse. This consists of a surge generator that duplicates the steep wave front of lightning. A total of 1,500,000 v can be produced by the discharge of power held in eight condenser sections. The sections are charged in parallel by a 200,000-v rectifier, then connected in series for discharge.

3. High current. This test set consists of an arrangement of transformers that provides high currents —up to 200,000 amp—at low voltage for various short time current tests on all types of switchgear. Primary voltage is 20,000 v.

In addition, the lab also will house comprehensive equipment and facilities for such design tests as heat runs, mechanical operation and material checks.

► **Edward C. Buurma,** formerly manager of product development of Sequoia Wire and Cable Company, has been transferred to the parent company, Anaconda Wire and Cable Company.



Artist's drawing of BullDog Electric Co.'s new Los Angeles plant and office building, located at the corner of Supply and Sycamore Streets in the Simmons Tract off the Santa Ana Freeway. According to President Paul L. Mullenbach, the new facility will consolidate present separate manufacturing and warehouse buildings and will employ 150 people. The 200x400-ft building covers a 48,000-sq-ft area, including 5,000 sq ft of air conditioned offices. Total investment in the facility will exceed $750,000, Mullenbach said

Now used in transformers and switch gear totaling over 25 million kw capacity

Shell Diala Oil AX has an enviable preference record in the electric power industry. This is due to its exceptional oxidation stability, plus high dielectric strength and low pour point. It all adds up to the utmost in reliability, equipment protection and long life.

Shell Diala Oil AX is inhibited to prevent oxidation . . . it has established new high standards throughout the industry. Actual tests show that Diala® Oil has two to three times greater stability than conventional oils.

Let a Shell Representative tell you about Shell Diala Oil AX. Write or call: Shell Oil Company, 50 West 50th St., New York 20, N. Y., or 100 Bush St., San Francisco 6, California. In Canada: Shell Oil Company of Canada, Limited, 505 University Ave., Toronto 2, Ontario.

SHELL DIALA OIL AX

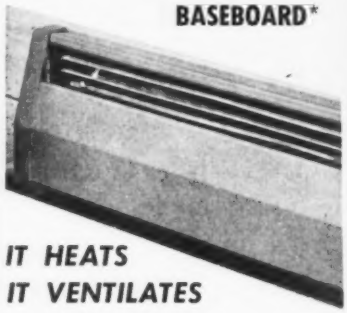
the inhibited insulating oil

SHELL

PREMIUM COMFORT...

REASONABLY PRICED

WITH HEATSUM VENTILATED BASEBOARD*



IT HEATS
IT VENTILATES
IT CAN FILTER
THE AIR TOO

*MANUFACTURED ONLY BY:

ROBERSON INC.
7116 220TH SOUTHWEST
MOUNTLAKE TERRACE, WASH.

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life

EVERSTICK ANCHORS

For new construction and maintenance — Everstick Anchors speed up work and provide dependable anchorage on all types of jobs. Made of resiliant, rust resistant malleable iron. The toughest anchors made. Write for bulletin.

EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

Association Affairs

Grace Cathedral in San Francisco was the setting for a pageant of sound and light

Sound and Light to Herald the IES

A spectacle of light and sound, called "Son et Lumiere" in France as a new art form, was presented to the Illuminating Engineering Society convention attendants and public Sept. 7 outdoors at the Grace Cathedral on Nob Hill, San Francisco, by the lighting and decoration committee.

"Let There Be Light," designed and directed by James Jewell of Holzmueller Corp., theatrical specialists, had a script written and narrated by William Siden, special music by Jack Philpot and adroit sound engineering by Harold Bonner. It was a blending of sound—spoken, orchestral, organ and choral on tape with the actual carillon of the cathedral played brilliantly—and light and color in a coordinated interpretation.

The lighting played upon the north faces of the tower and cathedral in varying color patterns and even the stained glass windows of the cathedral were illuminated and engaged in the pageant. Assistance was also given by the Dean and theologian of Grace Cathedral and its choir, PG and E, the city of San Francisco and Shalda Mfg. Co. Repetition has been requested.

► The Northwest Electric Heat Assn. has been organized by utility representatives, electric heating equipment manufacturers and affiliated industries with Ken Crow, power use consultant for the Grant County PUD, as its first president. Cecil Penney, commercial manager of the Clark County PUD at Vancouver, Wash., is treasurer of the group, which plans to encompass the seven Western states.

SALES REPRESENTATIVE WANTED

By a leading national electrical manufacturer for southern California area. Applicant should have BS in Electrical Engineering or equivalent and experience in Electric Utility field. Salary based on qualifications —$7,000 - $8,000—Bonus, profit-sharing and other benefits—car and expenses. Replies confidential. Write Box 305, Electrical West, San Francisco 4, Calif.

REPRESENTATIVE WANTED

Sales representative or sales organization wanted to contact Fixture Manufacturers, Architects, Engineers and Electrical Distributors to sell new line of plastic diffuser panels for fixtures. Large potential. New and replacement market. Advertising program. Contact Lightonics, Box 7211, Oakland, Calif.

Completing Apprentice Bill Henline receives disploma from Art Siegal

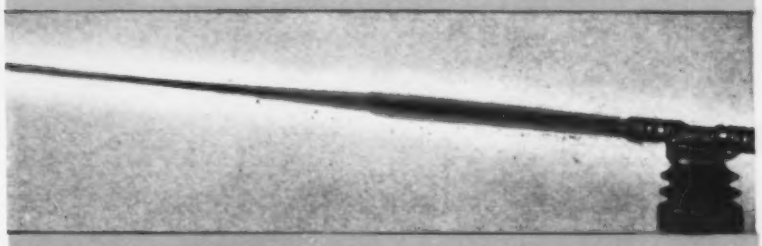
► Certificates of completion of their apprenticeship were given to 40 graduates of Seattle Area Joint Apprenticeship and Training Committee at a banquet, entertainment and dance held by Local 46, IBEW, and the Seattle area industry recently. Arthur Siegel, Selo Electric Co., employer member and chairman, made the presentation. Gene Nelson, business manager of Local 46, congratulated the graduates. Mike Stevens, president of the local, was master of ceremonies and thanks were accorded Arne Bergene, instructor at the vocational school, and William Wilbur, coordinator. Also honored was Walter V. Moore, who is retiring after 15 years as head of the educational department of Edison Technical School and 47 years with IBEW.

► NEMA's Air-Conditioner Section will give its first annual **Snowman Award** in 1959. Going to the manufacturer whose **Beat the Heat** campaign is judged tops will be a 10-in. statuette, Mr. Snowman, designed by John Russell Ridge.

► **Al Krieg,** executive manager of Northwest Electric Light and Power Association, has been re-elected treasurer of the Agricultural Engineering Research Foundation. **Berkeley Snow,** Krieg's predecessor as NELPA manager until his retirement a few years ago, was a principal speaker at the group's 25th annual meeting in Portland.

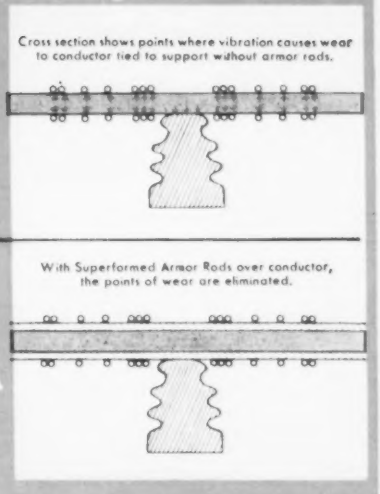
► **Robert W. Retherford,** electrical consulting engineer for rural electric cooperatives throughout Alaska, has been presented the Milton Hunt McGuire engineering achievement award presented annually by the Northwest Public Power Association. He was cited for high engineering standards in pioneering the formation of new systems in unserved areas.

TAKING THE PUNISHMENT OF WIND VIBRATION



FANNER *Superformed** ARMOR RODS

CUSHION CONDUCTORS against DAMAGE!


Cross section shows points where vibration causes wear to conductor tied to support without armor rods.
With Superformed Armor Rods over conductor, the points of wear are eliminated.

Even at low wind velocities, overhead lines are often subjected to thousands of stress reversals per minute due to aeolian vibration.

With Fanner Superformed Armor Rods installed at points subject to stress and abrasive wear, the conductor receives the best protection against vibration damage as well as electrical burning . . . and many expensive line repairs are eliminated.

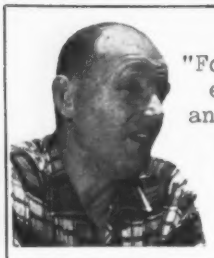
Fine FANNER Superformed Products

FF ARMOR RODS FF FANNSPLICES FF FANNGRIPS
FF LINEGUARDS FF PATCH RODS FF TAP ARMOR
FF PLASTIC FANNGUARDS FF KOVERGARD MOLDINGS

THE FANNER MANUFACTURING CO.
BROOKSIDE PARK CLEVELAND 9, OHIO
Electrical Products Division

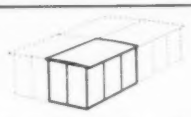
*Trademark

Licensed for use under or made in accordance with one or more of the following patents: Patent No. 2,587,321, 2,709,479, 2,888,483 . . . Other patents pending.



"For a combination electrical field office and storage shed that's quick to move on and off the job, I like Porta House. We have them on several jobs."

Just telephone Porta House collect and get immediate delivery. Prefabricated, bolted, waterproof plywood panels—can be moved on a pick-up truck.



SIZES 6' OR MORE BY 9' OR MORE.

PORTA HOUSE

Ridgely K. Dodge 6767 Broadway Terrace, Oakland, Calif.

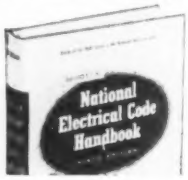
Phone collect for immediate delivery: OLympic 2-7237

Now in Revised 9th Edition!

ABBOTT'S NATIONAL ELECTRICAL CODE HANDBOOK

Here is the electrical contractor's job book, **completely revised** to conform with the 1956 Code requirements—designed to help you understand and do work in accordance with the National Electrical Code. In this handbook you will find explanations of rules and measurements for the various types of jobs—what they mean—how to apply them. Wherever a ruling lacks clarity, it is carefully reviewed and its application explained. Diagrams, sketches, and illustrations used freely. 9th Ed. Revised by C. L. Smith. 642 pp., 594 illus., 34 tables. $9.00.

10-day Free Examination



McGraw-Hill Book Co., Dept. FWest 10/59
327 West 41st St., New York 36, N.Y.

Send me Abbott's **National Electrical Code Handbook—9th Edition** for 10 days' examination on approval. In 10 days I will remit $9.00 plus few cents delivery; or I will return the book postpaid. (We pay delivery costs if you remit with this coupon—same return privileges.)

(PRINT)

Name .....

Address .....

City ..... Zone.... State.....

Company .....

Position .....

For price and terms outside U.S. write McGraw-Hill Int'l, N.Y.C. FWest-10-59

STATEMENT REQUIRED BY THE ACT OF AUG. 24, 1912, AS AMENDED BY THE ACTS of March 3, 1933, and July 2, 1946 (Title 39, United States Code, Section 233) showing the ownership, management, and circulation of Electrical West, published semi-monthly (except November when published tri-monthly) at Portland, Oregon, for October, 1959.

1. The names and addresses of the publisher, editor, managing editor, and business managers are:
Publisher, C. W. Leihy .....68 Post St., San Francisco 4, Calif.
Editor, C. W. Leihy.....68 Post St., San Francisco 4, Calif.
Managing Editor .....None
Business Manager, T. H. Carmody, Jr.....68 Post St., San Francisco 4, Calif.
Published by McGraw-Hill Company of California.....68 Post St., San Francisco 4, Calif.

2. The owner is McGraw-Hill Publishing Co. Inc., 330 West 42nd St., New York City 36, N. Y. Stockholders holding 1% or more of stock are: Donald C. McGraw & Williard T. Chevalier, Trustees under Indenture of Trust m/b James H. McGraw, dated 1/14/21 as modified; Donald C. McGraw & Harold W. McGraw, Trustees under an Indenture of Trust m/b James H. McGraw, dated 7/1/37 as amended; Donald C. McGraw, individually (all of 330 West 42nd St., New York City 36, N. Y.); Mildred W. McGraw, Madison, New Jersey; Grace W. Mehren, 536 Arenas St., La Jolla, Calif.; Affiliated Fund, Inc., 63 Wall St., New York City, N. Y.; Genoy & Co., P. O. Box 491 Church St. Station, New York City, N. Y.; Touchstone & Co., c/o Wellington Fund, Inc., Claymount, Delaware.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

C. W. Leihy, Publisher.

Sworn to and subscribed before me this 21st day of September, 1959.

[SEAL] LOIS B. PITKIN

Notary Public in and for the City and County of San Francisco, State of California.

(My commission expires June 21, 1963)

People

Armstrong

Beier

► At a recent meeting of the board of directors of Colorado Central Power Co. **Lee R. Jones** was designated as executive vice-president. **J. E. Wilson** is new vice-president-commercial. **E. G. Armstrong** is vice-president of finance and still secretary and **F. William Beier** is treasurer, succeeding Armstrong. As executive vice-president, Jones will be in charge of operations, engineering and construction.

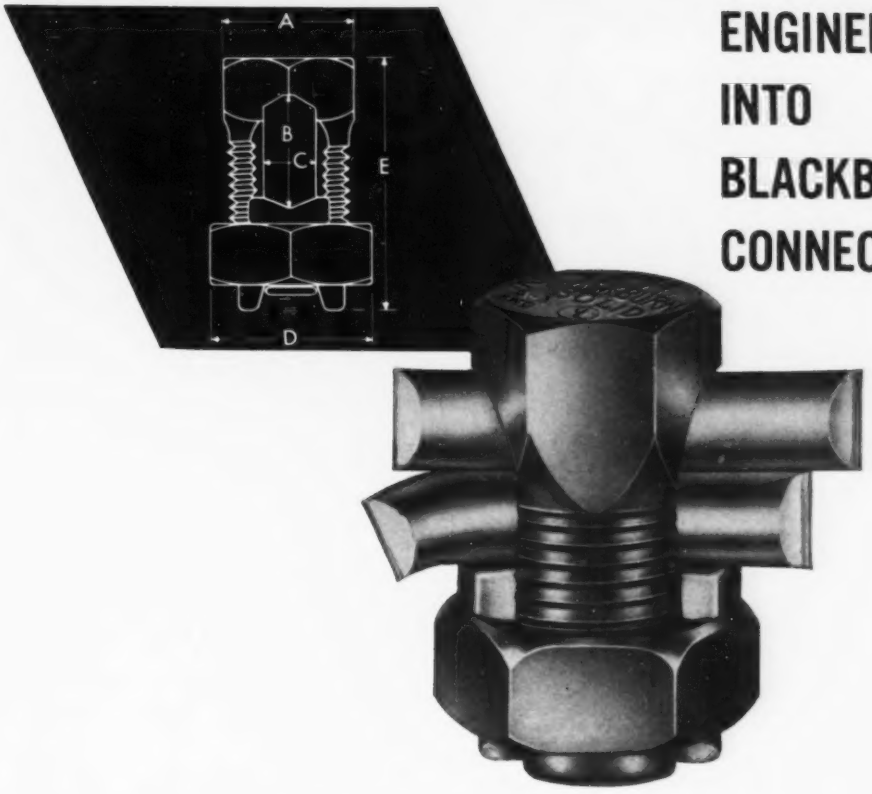
Jones

► **Charles E. Nolan,** vice-president and promotional manager of Hawaiian Electric Company, recently announced that he will retire Dec. 31. Nolan has been with the company more than 38 years, and has directed HECO's advertising and promotion for many years. In the past 12 years the company's advertising has won numerous awards in nationwide competitions conducted by the Public Utilities Advertising Association of America.

Nolan

► **John B. Sweat** has been appointed executive secretary of the Columbia Interstate Compact Commission. He succeeds **Calvert Anderson,** who resigned last year to accept a position in Costa Rica.

► **W. Ryland Hill,** professor of electrical engineering at the University of Washington and author of "Electronics in Engineering" published by McGraw-Hill Publishing Company, has been appointed associate dean of the College of Engineering.



ENGINEERED INTO BLACKBURN CONNECTORS...

REUSABILITY!

The big difference in Blackburn connectors starts with the way they are made. The basic material is high strength duronze, a silicon bronze alloy stronger than many structural steels.

High percentage of threads, both bolt and nut, plus proper selection of materials, reduces friction, increases thread efficiency and clamping force—clamping force is maintained on the conductors. Blackburn's strict inspection assures uniform high quality.

Blackburn connectors give better performance electrically. The greater thread efficiency provides a high clamping force that helps break through oxides on the conductor and improves conductivity. This high initial conductivity is maintained permanently.

Because of the better materials, precision workmanship and careful inspection, Blackburn connectors are reusable . . . over and over. Write for samples.

LIVE BETTER ELECTRICALLY

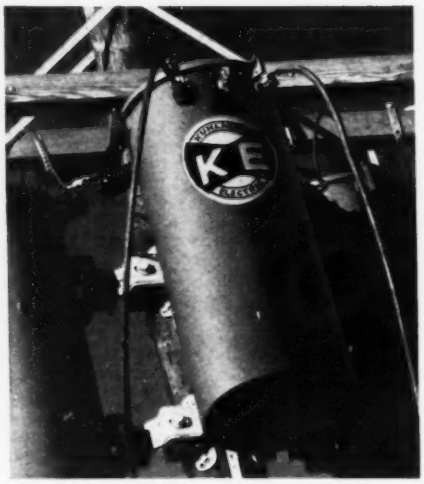
Jasper
BLACKBURN
Corporation

1525 Woodson Road • St. Louis 14, Mo.

For phone number of closest representative see advertising index in back of book.

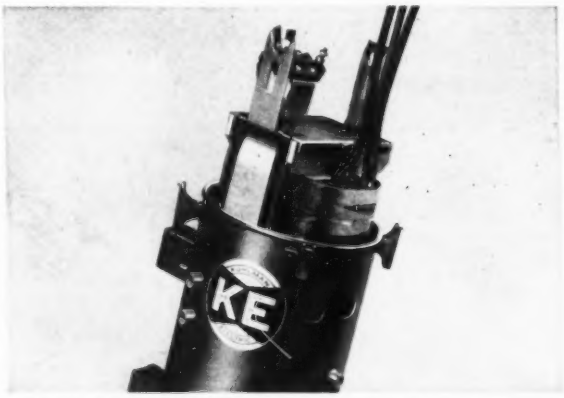
FOUR WAYS TO GET MORE FOR YOUR TRANSFORMER DOLLAR THIS YEAR

REDUCE OPERATING LOSS—New Kuhlman transformers' lower losses conserve generating capacity; put less drain per transformer on your system.



USE SMALLER TRANSFORMERS—to boost KVA per pole. New Kuhlman designs come in smaller tanks. The same KVA now takes up less room on the pole.

IMPROVE REGULATION—to fill new demands of "Electric-Living". New Kuhlman lower impedance, better regulation means less voltage drop and loss of revenue during heavy loading hours.



COMPARE VALUE—This year Kuhlman offers a bigger core and coil in a smaller tank. Result: lower losses, better performance at no extra cost to you.

Get The Most For Your Transformer Dollar. Buy Kuhlman—Now!

KUHLMAN TRANSFORMERS

KUHLMAN ELECTRIC COMPANY, Birmingham, Michigan

Manufacturers of transformers since 1894

WESTERN DIVISION • SALINAS, CALIFORNIA

For phone number of closest representative see advertising index in back of book.

PSP&L Elects Clawson

Frank McLaughlin, president and director of the Puget Sound Power & Light Co., has been elected chairman of the board of the company.

McLaughlin has been president and director of the company, and its subsidiary, Diamond Ice & Storage Co., since 1931. As board chairman, he will be top managing officer.

The board of directors also elected J. H. Clawson president and director. Clawson joined Puget Power in 1927 as an auditor. He was promoted to assistant treasurer in 1936, and in 1946 was made comptroller.

The following year Clawson was named treasurer—later senior vice-president, and now president and director.

► **L. M. Robertson,** chief electrical engineer of Public Service Co. of Colorado, has been named manager of engineering. **A. A. Woodward** is now manager of electric operations. **G. C. Farnsworth** is supervisor of electrical engineering and **Charles Waselkow** is manager of mechanical engineering. New supervisor of structural engineering is **H. W. Hight.**

Lefferty

Halloran

► **Robert E. Halloran** has been named Pacific Coast sales manager of the Babcock & Wilcox Co.'s tubular products division. He succeeds **H. F. Lefferty,** who is retiring after more than 40 years of continuous service with the company. Halloran joined Babcock & Wilcox in 1941. Lefferty leaves the sales manager position he has held with the company since 1950.

► **Frank C. Miramontes** has been appointed director of agricultural sales of Pacific Gas and Electric Co. He succeeds **H. W. "Walt" Clingman,** who has been named commercial manager of the company's Colgate Division, with headquarters in Marysville. Miramontes is a native of Redwood City and an electrical engineering graduate of the University of Santa Clara. He has been with the company 27 years.

► **Walter L. Lassen** has been appointed sales representative for the state of Montana and part of Wyoming for R. T. & E. Corporation's Portland division. He will be located at 703 Custer St., Billings, Mont.

► **Barney H. Hartley** has been appointed electromagnetic control sales representative in Arizona for Automatic Switch Company. He will be at 708 Willetta St. in Phoenix.

Harrison

Matteson

Kaiser Promotions

R. J. Harrison, E. K. Matteson, and J. G. Johnson have received promotions in the electrical conductor division of Kaiser Aluminum and Chemical Sales Incorporated. Harrison is now division market sales manager, Matteson is manager of utility sales and Johnson manager of industrial sales. The promotions occurred at the same time the division's general sales office moved from Chicago to Oakland.

Johnson

Harrison will direct activities in market planning, advertising and promotion. He has been with Kaiser for 10 years and was formerly manager of utility sales, the new position for Matteson. Johnson leaves a post as north central regional manager in Chicago to assume his new duties as the electrical conductor division's industrial sales manager.

► **George Hochwalt,** who has been in charge of the hydraulic division of Allis-Chalmers in the Northwest, has been transferred from Seattle to the firm's Chicago office.

► **Joseph R. Warren** has been elected president of the Royal Electric Manufacturing Company Inc., manufacturer of transmission and distribution equipment. **Edward J. Gessner** has been elected vice-president and secretary-treasurer, and **James L. Warren** was elected to vice-president and plant manager.

Western states accounted for a majority of Westinghouse business in 1959. This was the report made by John K. Hodnette, left, chief executive vice-president, and Mark W. Cresap Jr., center, president, to Walter J. Maytham, Pacific Coast vice-president, while the executives visited Westinghouse facilities near San Francisco in September

► **F. Eric Vandersyde** has been appointed general manager of Western Switchboard Company, manufacturer of electrical switchgear and industrial control. He is replacing **R. R. Crooke** who is remaining with the company in an advisory capacity. Vandersyde was formerly with Food Machinery and Chemical Corporation and prior to that, switchgear specialist for Nelson Electrical Manufacturing.

Changes

Organizational changes involving a number of supervisory personnel have been announced by the Puget Sound Power & Light Company.

Forrest Frost has been promoted from supervisor of systems and procedures to supervisor of the auditing and systems procedures department.

Clifford B. Keith now is auditor, after serving previously as chief clerk.

John H. Kreig, chief clerk at Bellingham since 1955, has been promoted to office manager of the Northern division to succeed William J. Pfluege, who retired August 1.

Philip T. Rosser, local supervisor at Burlington since 1957, is the new local manager at Bellingham.

Rosser's former post at Burlington has been filled by Milton E. Erickson, Northern division credit supervisor at Bellingham, who in turn is replaced by Wayne H. Caldwell, junior accountant in the company's general offices at Bellevue since 1955.

The new local manager for Kittitas County, with headquarters at Ellensburg, is Robert Radnich, succeeding Walter C. McDougall, who retired July 15.

INDEX TO ADVERTISERS AND WESTERN SALES OFFICES

October 1959

Accurate Mfg. Co. 122
San Francisco: The Curry Co. YUkon 2-0788
Los Angeles: F. J. Airey Co. MAdison 3-2706
Seattle: Electric Agencies MAin 3-2360
Denver: L. B. Putnam Co. TAbor 5-5066
Salt Lake City L. B. Putnam Co. ELgin 5-5558

Allen-Bradley Co. 119, 120
Los Angeles ANgelus 9-9421
San Francisco: Campbell & George MIssion 8-1236
Denver: Young Electric AComa 2-4841
Albuquerque: A & A Supply ALpine 6-0307
Salt Lake City: Stevens Sales INgersoll 7-5489
Phoenix: Edw. P. Weller AMherst 6-3188
Seattle: J. A. Tudor Associates MUtual 2-7444
Portland: J. A. Tudor Associates BElmont 2-1188

Allis-Chalmers Mfg. Co. 30, 31, 111, 113
San Francisco DOuglas 2-8384
Los Angeles MAdison 6-2231
Phoenix CRestwood 4-5426
Denver CHerry 4-6556
Salt Lake City EMpire 3-1723
Portland CApitol 2-9835
Seattle MAin 4-3737

American Steel & Wire Div., U. S. Steel Corp. 106, 107
Columbia Geneva Steel Div. in following cities:
San Francisco SUtter 1-2500
Los Angeles LUdlow 5-1171
Portland CApitol 2-9534
Seattle MAin 2-1972
Salt Lake City DAvis 2-0491

Anaconda Wire & Cable Co. 53, 54, 55, 56
San Francisco YUkon 6-0051
Los Angeles MAdison 6-2371
Denver AComa 2-0616
Salt Lake City DAvis 8-0616
Seattle MAin 3-4686

Bechtel Corp. 23
San Francisco DOuglas 2-4032
Los Angeles MAdison 6-6721

Blackburn Corp., Jasper 131
Los Angeles: Robert M. Schow HUbbard 3-7931
Oakland: John H. Ormond Co. TWinoaks 3-3235
Vancouver, Wash.: Bill Horning Sales OXford 4-4475
San Francisco: Kortick Mfg. (Ground Rods) VAlencia 6-6107

BullDog Electric Products Div., I-T-E Circuit Breaker Co. 47, 49
Oakland: Safety Switchboard Co. LOckhaven 9-7001
Los Angeles: BullDog Elec. Products of L. A. ANgelus 9-8101
Portland: Coast Elec. & Mfg. Co. ATlantic 8-5373
Denver: Young Elec. & Mfg. Co. AComa 2-4841

Carol Cable Div., Crescent, Inc. 9
San Francisco: F. M. Nicholas Yukon 2-1964
Los Angeles: Jack Payne Co. MAdison 4-7317
Seattle: Bruce-Emmett Co. MUtual 2-6737
Portland: Bruce-Emmett Co. BElmont 2-8117

Careske Co., Wm. 122
Oakland TEmplebar 2-3546

Circle Wire & Cable Co. 29
San Francisco: Brill Electric Sales SUtter 1-7547
Los Angeles: Elkins Electric Agency ANgelus 8-3385
Seattle: Electric Agencies MAin 3-2360

Classified 128

Columbia Geneva Steel Div. 106, 107

Condon Co., Earl S. 20
Los Angeles DUnkirk 1-3951

Copperweld Steel Co. 19
Los Altos, Calif. YOrkshire 7-4556
Bellevue, Wash. GLencourt 4-1233

Davey Tree Surgery Co. 118
San Francisco SUtter 1-3377
Los Angeles MAdison 3-1929

Dossert Mfg. Corp. 52
San Francisco: Curry Co. YUkon 2-0788
Los Angeles: Matzinger-Johnson Co. MAdison 4-8001
Oswego, Ore.: Henry G. Lehl NEptune 6-4210
Denver: R & M Sales Co. SPruce 7-2515
Salt Lake City: T. R. Van Wagoner INgersol 6-2461

Driver-Harris Co. 40
San Francisco: Angus-Campbell, Inc. ATwater 8-4208
Los Angeles: Angus-Campbell, Inc. LUdlow 7-1236

Dupont de Nemours & Co., E. I., Elastomer Chem. Dept. 58, 59
Los Angeles LUdlow 2-6464
San Francisco DAvenport 6-7550
Seattle MElrose 2-6977
Portland CApitol 7-1281
Denver AComa 2-2347
Salt Lake City EMpire 4-3582

Edwards Company, Inc. 121
Los Angeles MAdison 8-2286
San Francisco UNderhill 1-5800
Denver: H. F. Ream Sales Agency CHerry 4-0558
Phoenix: J. A. Ware, Jr. Alpine 2-9388
Portland: D. A. King CApitol 8-1990
Seattle: F. A. Strohecker MAin 3-0357
Spokane: E. Johnston MUtual 2-3597

Electric Tube Products 100
Los Angeles: Weingart & Lustig ADams 3-4111

Electrical Industry Show 6
Los Angeles: Fred J. Tabery RIchmond 9-1091

English Electric Co. Ltd. 48
New York City Murray Hill 7-0303
James I. Metcalf & Co. Inc. in following cities:
Seattle MAin 4-6322
Portland CApitol 6-6096
San Francisco GArfield 1-0653
Los Angeles MAdison 2-3019
Phoenix ALpine 8-4696

Everstick Anchor Co. 128
Joslyn Pacific Co. in following cities:
Los Angeles LUdlow 7-4251
San Francisco UNderhill 1-7313
Seattle MAine 3-1957
Portland CApitol 3-5127
Graybar Electric Co. in following cities:
San Francisco MArket 1-5131
Denver TAbor 5-7111
Denver: Paul A. Douden KEystone 4-6798
Denver: Hendrie & Bolthoff Co. KEystone 4-4111

Fanner Mfg. Co. 129
San Francisco: Sold Through Line Material Industries PLaza 5-8600
Los Angeles RAymond 3-6251 and OXford 5-2260
Phoenix ALpine 4-8471
Denver: Slaybaugh & Thompson AComa 2-5826
Portland: A. L. Polich CApitol 3-6241

Fisher-Pierce Co. Inc. 26, 27, 123
San Francisco: Maydwell & Hartzell ATwater 8-6900
Los Angeles: Maydwell & Hartzell MAdison 8-7245
San Diego: Maydwell & Hartzell JU 2-6749
Phoenix: Maydwell & Hartzell ALpine 2-5858
Seattle: Oscar Hogenson MAin 2-0737
Portland: J. A. Tudor Asso. BElmont 2-1188
Denver: Allen I. Williams MAine 3-0343

Gedney Electric Co. 7
San Francisco: Baxter Co. MArket 1-8636
Los Angeles: Rutkin Electric Sales MAdison 3-1224
W. S. Sanderlin Co. in following cities:
Seattle ATwater 4-7777
Portland BElmont 5-0121
Salt Lake City: George Darger Co. ELgin 5-2873

General Electric Co. Cleveland, Lamp Div. 42, 43
Oakland LOckhaven 9-3222
Los Angeles DUnkirk 5-1681
Denver AMhurst 6-0285
Seattle MAin 2-8081
Portland CApitol 3-2101

General Electric Co. Schenectady, Apparatus Div. 14, 15, 24, 25, 33, 34, 35, 57
San Francisco DOuglas 2-3740
Los Angeles MAdison 5-7381
Phoenix ALpine 8-7724
Denver KEystone 4-7171
Boise 4-3021
Salt Lake City EMpire 4-1891
Portland ATwater 8-0281
Seattle MAin 4-8300

Hathaway Instrument Div. Hamilton Watch Co. 63
Denver SKyline 6-8301
Pasadena, Calif. RYan 1-7829
Albuquerque, N. M.: A. I. Williams Co. ALpine 5-9632

Hill Transformer Co. 4th Cover
San Carlos LYtel 3-2161
Los Angeles: Maddox Sales Co. MAdison 4-2306
Seattle: Wm. O. Proby & Assoc. MAin 3-3483
Portland: Wm. O. Proby & Assoc. CApitol 8-7261
San Francisco: Campbell & George MIssion 8-1236
Denver: H. C. Guire SPruce 7-2861
Salt Lake City: Stevens Sales INgersoll 7-5489
Phoenix: Maddox Sales Co. ALpine 2-2371
Albuquerque: Ralph D. Black Co. ALpine 5-9265

Hubbard and Co. 16
Emeryville, Calif. OLympic 2-6600
Los Angeles MAdison 4-8631
Oswego, Portland NEptune 6-2390
Salt Lake City INgersoll 7-5749

Hubbell, Inc., Harvey 112
San Francisco MIssion 7-3240
Los Angeles MAdison 8-7226
Denver: Paul A. Douden KEystone 4-6798
Spokane: Elmer Johnson MAin 2518
Seattle: Frank A. Strohecker MAin 3-0357
Portland: David King CApitol 8-1990

Indiana Steel & Wire Co. Inc. 22
Graybar in following cities:
San Francisco MArket 1-5131
Los Angeles ANgelus 3-7282
Portland CApitol 7-6641
Seattle MUtual 2-0123
Denver TAbor 5-7111
Salt Lake City ELgin 9-8771

International Business Machines 3rd Cover
Los Angeles DUnkirk 1-3696
San Francisco YUkon 2-0100
Denver AComa 2-9373
Seattle MUtual 2-4640
Portland CApitol 8-6623
Salt Lake ELgin 9-7721

Kaiser Aluminum & Chemical Corp. 60, 61, 98, 99
Oakland CRestview 1-2211
Los Angeles MAdison 6-4801
Denver ALpine 5-3459
Phoenix ALpine 3-4841
Portland CApitol 6-4351
Seattle MAin 3-7821
Spokane TEmple 8-2704

Kearney Corp., James R. 114, 115
Maydwell & Hartzell, Inc., in following cities:
San Francisco ATwater 8-6900
Los Angeles MAdison 8-7245
Seattle MAin 4-2368
Portland CApitol 8-4173
Spokane MAdison 4-3285
Phoenix ALpine 2-5858
San Diego JU 2-6749
Salt Lake City: Conely Engineering Co. EMpire 3-5013
Golden, Colo.: Ralph Smith CRestview 9-5279

INDEX TO ADVERTISERS AND WESTERN SALES OFFICES

October 1959

Killark Electric Mfg. Co. 104, 105
San Francisco: F. M. Nicholas YUkon 2-1964
Los Angeles: Kenneth Anderson Co. ANgelus 8-6771
Seattle: Northwestern Agencies, Inc. MAine 3-8882
Denver: Kenneth B. Schumann Co. AComa 2-8913
Phoenix: Kenneth B. Schumann Co. AMherst 5-2863

Klein & Sons, Mathias 10
Glendale, Calif. CItrus 3-3523
Sunnyvale, Calif. CHestnut 5-2310

KPF Electric Co. 44, 45
Stockton, Calif. HOward 4-8381

Kuhlman Electric Co. 132
Maydwell & Hartzell, Inc., in following cities:
San Francisco ATwater 8-6900
Los Angeles MAdison 8-7245
Seattle MAin 4-2368
Portland CApitol 8-4173
Phoenix ALpine 2-5858
Spokane MAdison 4-3285
San Diego JU 2-6749
Denver: Sales Engineers AComa 2-4893
Salt Lake City: Sales Engineers HUnter 5-3547

Lighting Dynamics 136
San Diego KImberly 5-4993
Los Angeles RAymond 3-9101
San Francisco JUniper 6-5266
Portland: Clyde Dodd CApitol 7-6557
Seattle: Don Gleason LAkeview 5-5151
Phoenix: Ray Wendling ALpine 2-2541

Line Material Industries 3
San Francisco PLaza 5-8600
Los Angeles RAymond 3-6251
Portland CApitol 2-1981
Seattle ATwater 3-6368
Spokane KEystone 5-2461
Salt Lake City ELgin 5-6257
Phoenix: J. E. Redmond Supply ALpine 4-8471
Boise Phone: 2-5706
Butte Phone: 8340
Denver FL 5-1689 and 1680
Sacramento, Calif. GI 2-6264

McGraw-Hill Book Co. 130

Moloney Electric Co. 64, 65
Garland Affolter in following cities:
San Francisco EXbrook 7-1800
Los Angeles MAdison 4-1864
Portland CApitol 3-7349
Seattle MUtual 2-4950
Denver: Hamilton Associates CHerry 4-1505
Salt Lake: Riter Engineering EMpire 3-7933

Morrison-Pelsue 118
Denver RAce 2-2834
North Hollywood: A. F. Johnson STate 7-8544
Salt Lake City: W. H. Pingree Co. EMpire 3-6731

National Supply Co., Tubular Prod. Div. 11
San Francisco DOuglas 2-2975
Los Angeles: Murphy-Hain Co. MAdison 2-2138
Seattle: J. H. Stumph MUtual 2-5232
Denver: Allen B. Carpenter KEystone 4-0283
Farmington, Utah: David Merrill AXtel 5-4631

OZ Electrical Mfg. Co. 4, 5
San Francisco:
Eichorn & Melchior DOuglas 2-1038
Los Angeles: Agencies Co. MAdison 6-5443
Denver:
Harry F. Ream Sales Agency CHerry 4-0558
Portland:
Wm. A. Proby Associates CApitol 8-7261
Seattle: Wm. A. Proby Associates MAin 3-3483

Pacific Gas and Electric Co. 46
San Francisco SUtter 1-4211

Paranite Wire & Cable Div., Essex Wire Corp. 36
Los Angeles RAymond 3-4794
South San Francisco PLaza 6-3030
Portland CApitol 3-6124
Seattle MAin 3-5641

Pennsylvania Transformer Div. 101, 102
San Francisco: George E. Honn Co. SUtter 1-7352
Los Angeles: John G. Corrin MAdison 2-0830
Seattle: Fred W. Carlson ATwater 4-4630
Phoenix: Roy E. Coulson Windsor 3-8935
Denver: Peterson Co. DExter 3-5434
Salt Lake City: Clarence W. Silver ELgin 5-5378
Portland:
Fred W. Carlson & Associates CApitol 8-3798
Boise, Ida.: Clarence W. Silver Co. 2-6947
Albuquerque:
Williamson Sales Co. ALpine 6-6617

Petersen Engineering Co. 103

Phelps-Dodge Copper Products Corp. 125
San Francisco EXbrook 2-7379
Los Angeles RAymond 3-1311
and PArkview 1-1191
Seattle MAin 3-6790
Denver CHerry 4-9291
and CHerry 4-9292

Porta House 130
Oakland OLympic 2-7237
Sacramento: Robert Crownin GIlbert 3-8543
Portland: Bardi Gen. Contractors PRospect 5-4354
Los Angeles: Construction Supply Co. LUdlow 3-4158
Los Angeles: Ball & Black ANgelus 9-7586
San Bernardino: Kingsley, H. P. TUrner 9-8551
Santa Ana: Blystone Equip. Co. KImberly 2-3918

Precision Magnetic Controls, Inc. 37
San Francisco:
C. E. Ingalls & Sons GArfield 1-2916
Los Angeles: Industrial Engineering & Equip. Corp. DUnkirk 1-1281
Denver: Jim Dawson Co. ALpine 5-7194
Salt Lake City:
Leonard M. Slusser ELgin 5-2322
Vancouver, Wn.:
Bill Horning Sales OXford 4-4475

Ownership Statement 130

R T & E Corp. 2nd Cover
Portland MErcury 9-2161
Medford: H. L. Mooney SPring 2-9948
San Jose: N. R. Beebe ANdrews 4-5641
Pasadena: D. B. Cole SYlvan 0-5977
Salt Lake City: T. R. Van Wagoner Co. INgersol 6-2461
Bellevue, Wn.: K. H. DuBois SHerwood 6-4114
Butte: R. A. Manning Butte 2-9200

Republic Steel Corp. 41
San Francisco GArfield 1-0977
Los Angeles MAdison 4-5144
Portland: Shaffer & Nelson Inc. BElmont 4-7437
Seattle: Shaffer & Nelson Inc. MUtual 2-0186
Spokane: Shaffer & Nelson Inc. FAirfax 7-9528
Denver: C. D. Belt Co. SKyline 6-9421

Roberson, Inc. 128
Seattle LAkeside 3-1189
Seattle: Palmer Electric Co. MA 2-2170
Spokane: Wm. C. Knapp FAirfax 7-3621
Spokane: Inland Electric Co. FAirfax 7-1521
Tacoma: Bean Electric Co. MArket 7-3144
Los Angeles: O. B. Wilt Co. NOrmandy 1-4100
San Carlos, Calif.: O. B. Wilt Co. LYtel 1-2618
Graybar Electric Co. Inc., all principal cities

Royal Electric Co. Inc. 21
Los Angeles: Eckert-Lloyd Co. RIchmond 7-9655
San Francisco: Eckert-Lloyd Co. HEmlock 1-5792
Seattle: Northwestern Agencies MAin 3-8882
Portland: Northwestern Agencies CApitol 7-0434
Phoenix: Wm. Benndorf CRestwood 7-1662
Denver: Hyde Electronics Co. WEst 6-3456

S & C Electric Co. 50, 51
Burlingame, Calif. OXford 7-1130
El monte, Calif.: Randolph Eng. Corp. CUmberland 3-4183 and 3-7901
GIlbert 3-1701
Phoenix: Randolph Eng. Corp. ALpine 8-5281
Salt Lake City:
Riter Engineering INgersoll 7-9449
Seattle: Muth-Richards Co. EAst 3-2128
Portland: Andrew L. Polich, Inc. CApitol 3-6241

Shell Oil Co. 127
San Francisco EXbrook 2-5400
Los Angeles MAdison 5-7341

Southern California Edison Co. 66
Los Angeles MAdison 4-7111

Southern States Equipment Corp. 38, 39
Seattle: Jos. C. Platt MAin 3-6141
Salt Lake City: H. Lee Rawlings Co. ELgin 9-8811
Denver: R. T. Lewis Co. EAst 2-1082
Los Angeles: W. E. Kirk Co. MAdison 4-3651
Portland: C. F. Selby NEptune 6-6442
Oakland: John H. Ormond TWinoaks 3-3235

Square D Co. 13
Los Angeles CApitol 1-1171
San Francisco JUniper 7-4590
Seattle EAst 3-1474
Portland BElmont 4-8488
Denver KEystone 4-6234
Salt Lake City DAvis 2-5859
Phoenix ALpine 8-6448
El Paso KEystone 3-0544
Spokane FAirfax 8-3690
San Diego BElmont 3-7621
Fresno AMherst 8-6268

Standard Oil Co. of Calif. 32
San Francisco SUtter 1-7700
Los Angeles MAdison 4-2711
Portland CApitol 3-4161
Seattle MAin 3-6310
Salt Lake City DAvis 2-5831

Truck Equipment Co. 12
Los Angeles: Calavar Corp. RIchmond 8-6292
Oakland: Dailey Body Co. KEllog 4-1423
Portland: Schetky Equipment Corp. BEaverton 4-5344
Spokane: Leland Trailer & Equip. Co. KEystone 4-0591
Salt Lake City: W. H. Pingree Co. EMpire 3-6731

U. S Steel Corp., American Steel & Wire Div. 106, 107

Virden Lighting, Division of John C. Virden Co. 117
Atherton, Calif.: W. G. Sawyer DAvenport 5-4931
Fullerton: Wm. K. Newell TRojan 1-1845
Phoenix: Ray E. Wendling ALpine 2-2541
Seattle: Donald S. Gleason LAkeview 5-5151
Portland: Clyde E. Dodd BUtler 5-3271

Wagner Electric Corp. 94, 95
South San Francisco PLaza 6-0520
El Segundo, Calif. ORegon 8-7671
Portland CApitol 7-3654
Salt Lake City EMpire 3-5013
Denver CHerry 4-7421
Seattle MAin 2-2342

White-Rodgers Co. 28
Los Angeles MAdison 8-1211
Portland BElmont 4-7523
San Francisco: Kenneth Hill WEst 1-2612
Mountlake Terrace, Wash.: L. Wren PRospect 6-5931
Denver BElmont 7-0709

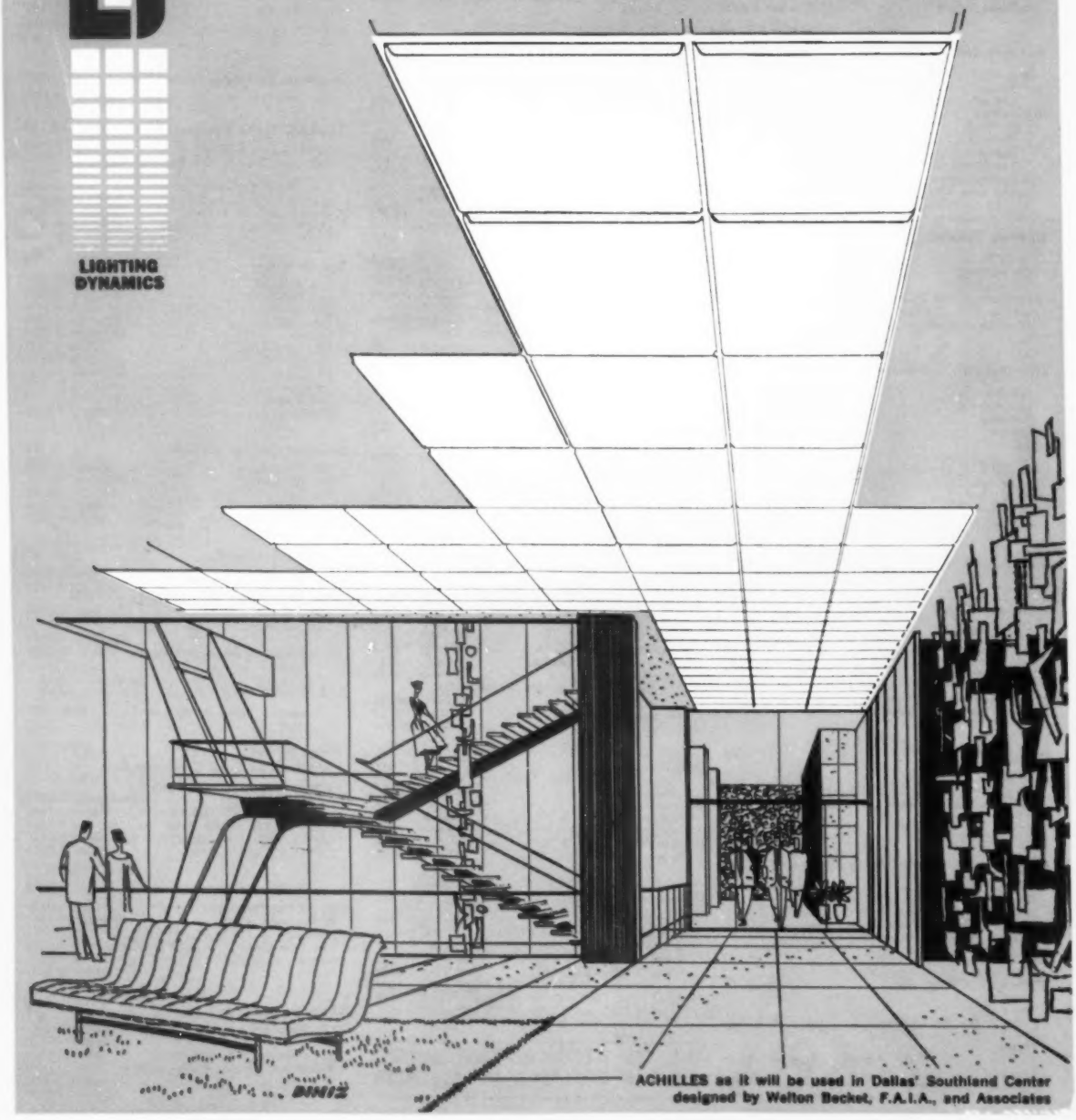
USE THE ELECTRICAL WEST BUYERS' GUIDE & DIRECTORY IN NOVEMBER

problem solution

An easily maintained, integrated fixture was needed for Welton Becket's dramatic "squares of light" ceiling in the lobbies and offices of Southland Life's spectacular 42-story Southland Center in Dallas.

ACHILLES by Lighting Dynamics was specified for the lobby... and it's companion Apollo was used in the offices throughout the center. Achilles is a highly versatile fixture series ideal for this demountable acoustical ceiling—just as it is for countless other ceiling suspension systems. It's quickly installed with a drop-in installation and has easy maintenance with press-to-open catches and hook-on hinges. Durable, Bonderized and electro-static, high-reflectance finishes... FOR MORE COMPLETE INFORMATION, call your Lighting Dynamics representative, or write to Lighting Dynamics, 802 West Whittier Blvd., Whittier, California or Lighting Dynamics, 8700 Ambassador Row, Dallas, Texas.

LIGHTING DYNAMICS



ACHILLES as it will be used in Dallas' Southland Center designed by Welton Becket, F.A.I.A., and Associates

IBM adds another volume to a growing library of programming

New Commercial Translator can save you more than 50% of your programming cost.

All automatic programming for the tasks of data processing has one common goal—a universal language that would eliminate all problems of conversion. Toward this goal IBM has contributed many major milestones. To name just a few:

1955 SOAP*—first widely used automatic programming system

1956 AUTOCODER—broadened the scope of automatic programming and paved the way for hundreds of generalized routines

1957 FORTRAN—a contraction of FORmula TRANslator—makes possible the swift translation of mathematical and scientific formulae to computer language.

Now, with the introduction of **Commercial Translator**, IBM takes the longest step yet toward the ideal of the universal machine language. With this significant advance, IBM bridges the gap between business and computer languages. Programs that might have taken highly trained experts months to prepare can now be written in a matter of days, even by people with little programming experience. For complete details, call your IBM representative. Let him show you how **Commercial Translator** protects your programming investment.

FORTRAN
Sort 57
SOAP II
Sort III
RAMAC® 650 Utility Programs
Merge II
305 Assembly Program
Sort 53A
705 Utility Programs—50 Series
FOR TRANSIT
305 Utility Programs
Merge 52
FORTRAN Primer
Sort 709
SOAP IIA
Sort 54
305 Chaining Programs
FORTRAN II
Autocoder
I/O Scheduling for RAMAC 650
704 DP Package
Merge 57
705 Utility Programs—70 Series

*Symbolic Optimal Assembly Program

IBM®
DATA PROCESSING

HE'S BUILDING EXTRA, SERVICE-FREE YEARS INTO YOUR NEXT TRANSFORMER

Coil winding... another fully-integrated phase of HILL manufacturing

Sound manufacturing practices... skilled employees using the most modern techniques and equipment... are only part of the reason why HILL produces transformers with *built-in* extra years of trouble-free service.

Equally important are HILL's complete, *fully-integrated* production facilities. One-management control of every step... from original design to final shipment... is an essential ingredient of quality control. Uniformly high test results on HILL transformers prove it!

Your thorough investigation of this all-Western source of power and distribution transformers is invited. Start today by writing for Catalog #2000

HILL TRANSFORMER CO., INC.
1030 WASHINGTON STREET SAN CARLOS, CALIFORNIA

HILL

"TRANSFORMERS THAT STAY IN SERVICE"

Sales representatives in Seattle, Portland, San Francisco, Los Angeles, Salt Lake City, Denver, Albuquerque, Dallas, Houston, Oklahoma City, Minneapolis and Honolulu.